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REPORT
ON THE OPERATIONS OF THE
DEPARTMENT OF AGRICULTURE,
BENGAL,
FOR THE YEAR
1920-21.



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CALCUTTA :
THE BENGAL SECRETARIAT BOOK DEPOT.
1921.

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DEPARTMENT OF AGRICULTURE, BENGAL.

No. 9594-A.

FROM G. EVANS, Esq., M.A., C.I.E.,

Director of Agriculture, Bengal,

TO THE SECRETARY TO THE GOVERNMENT OF BENGAL,

DEPARTMENT OF AGRICULTURE AND INDUSTRIES.

Dacca, the 19th July 1921.

SIR,

I have the honour to submit the Annual Report of the Agricultural Department, together with the reports of the expert officers, for the year 1920-21.

I have the honour to be,

SIR,

Your most obedient servant,

G. EVANS,

Director of Agriculture, Bengal.

DEPARTMENT OF AGRICULTURE, BENGAL.

No. 354-A

THIRU V. SIVAKUMAR, Esq., M.A., B.L.S.

Member of Legislative Council.

IN THE SECRETARY TO THE GOVERNMENT OF BENGAL.

Department of Agriculture and Irrigation.

Dated, the 10th July 1927.

I have the honor to acknowledge the receipt of the letter of the 4th

inst. in reference to the subject of the letter, and to inform you that the same has been forwarded to the

proper authorities for their consideration.

I am, Sir, very respectfully,

Sir,

Yours faithfully,

G. SIVAKUMAR.

Member of Legislative Council.

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[Maximum limit, 18 pages.]

REPORT
OF THE
AGRICULTURAL DEPARTMENT, BENGAL,
FOR
1920-21.

INTRODUCTORY.

The year under report has been a period of transition. In January the control of the Department passed from the Revenue Department of the old Government to the Ministry of Agriculture and Industries under the Reformed Government.

The immediate result of the change was a considerable increase in office work at headquarters. Apart from these considerations, however, it may be stated that the permanent work of the Department has been very little upset, and all members are confidently looking forward to an expansion of work and an increase in our sphere of usefulness to the country under the auspices of the new Government.

This report is intended to provide a brief but fairly comprehensive review of the operations of the Department of Agriculture in Bengal during the year ending March 31st, 1921.

Detailed information may be obtained by a reference to the appendices. These consist of the reports of the Deputy Directors of Agriculture and of the several Scientific Research officers.

SECTION I.—AGRICULTURE.

Administration.—On July 5th, 1920, I relieved Mr. R. S. Finlow, who had been officiating as Director of Agriculture, in addition to his own duties as Fibre Expert. The following were the principal changes in the *personnel* of the staff. Mr. F. Smith returned from leave early in April 1920 and resumed his duties as Deputy Director of Agriculture, Western Circle. Rai Rajeswar Das Gupta, Bahadur, Deputy Director of Agriculture, Northern Circle, went on leave in November 1920, and Mr. J. N. Sarkar, Superintendent of Agriculture, was appointed to officiate for him. Mr. G. P. Hector, Economic Botanist, continued to be on deputation at Pusa until the end of October 1920, and his work was performed by Mr. K. McLean, Deputy Director of Agriculture, Eastern Circle, in addition to his own duties, from April to June 1920 and by Mr. D. Datta, Superintendent of Agriculture, for the remaining period. Mr. M. Carbery, who was selected by the Secretary of State for the post of Agricultural Chemist, which had been rendered vacant by the transfer of Mr. H. E. Annett to the Opium Department, joined his new appointment in December 1920. Prior to his arrival, Mr. McLean carried on the work of the Chemical Section in addition to his own duties. A new post of 2nd Economic Botanist was sanctioned during the year, and Mr. D. Datta was appointed

temporarily to it in November 1920. Mr. N. Gupta, Superintendent of Agriculture, proceeded on leave in January 1921. Mr. H. P. Mitra, Superintendent of Agriculture, who was on special duty, reverted to regular work in January 1921, and was posted first to the Dacca Farm and afterwards to the Chittagong Division. Babu Kali Das Roy was confirmed in his appointment as Superintendent of Agriculture. Babu Chuni Lal Mustafi of the Subordinate Agricultural Service was appointed to officiate in the Provincial Service till the end of the year.

In the Sericultural Section three new posts, *viz.*, the Deputy Director of Sericulture, the 2nd Superintendent of Sericulture and the Sericultural Research Expert, were sanctioned. The office of the Deputy Director of Sericulture remained vacant during the year under report. Mr. P. C. Chaudhury was appointed as 2nd Superintendent in November 1920 and Miss M. L. Cleghorn as Sericultural Research Expert from September 1920.

During the year the permanent strength of the Upper Subordinate Agricultural Service, which includes Farm Superintendents and Agricultural Officers, was increased from 33 to 34. The permanent cadre of the Lower Subordinate Agricultural Service of Demonstrators consisted of 79 officers.

The question of staff is one that has received considerable attention. At present there are only three Deputy Directors for the five Civil Divisions and, in view of the recent expansion in the activities in the Department, it is not now possible for this number to cope with the work. I have noticed particularly that, apart from the Dacca Central Farm, the experimental work which is being carried out on the farms of the Department is of decidedly poor quality. This is an indication either that the Deputy Directors have not found time to inspect their farms sufficiently thoroughly or else that they are not sufficiently acquainted with experimental methods. Towards the end of the year administrative sanction was applied for the splitting up of the Western Circle and for the appointment of a separate Deputy Director of Agriculture for Burdwan Division. It is hoped that the Eastern Circle will also be split up and a separate officer appointed for Chittagong Division. Similarly, there is a shortage of the staff in the Subordinate Service, and it will be necessary to increase the demonstration staff in particular if the revised and expanded programme of work now under contemplation is to be properly carried out.

For like reasons the research staff requires strengthening in places, the Agricultural Chemist's Section in particular being understaffed at present.

Tours.—Mr. Finlow as Officiating Director was away from headquarters for 30 days. I spent 157 days on tour. The executive officers of the Department were constantly touring on inspection duty.

Agricultural Education.

The Principal of the Agricultural College at Sabour reports that during the 1920-21 session students from Bengal numbered 42. Eleven out of eighteen who appeared in the final examination were successful. Five scholarships were awarded by the Government of Bengal. Of these, one was held by a student in the second-year class and 4 by those in the first-year class. The stipend of one of the first-year students was stopped, as he failed to appear at the half-yearly examination. The reports about the others were of a satisfactory nature. Other Bengal students also held seven scholarships awarded by the District Boards of Mymensingh, Pabna, Jessore, Tippera, Chittagong and Noakhali, respectively. One student from the St. Andrew's Colonial Homes, Kalimpong, who had been given the Maling Grant scholarship, stood second among the first-year students in the annual examination. The one stipendiary sent by this Government to the Nagpur Agricultural College gained promotion to the second-year class.

The progress of nature study in primary schools and of agricultural classes in secondary schools as reported by the Education Department are not encouraging. These unsatisfactory results are attributed to the want of properly trained teachers and of necessary funds for the maintenance of the gardens.

Mention was made in last year's report of the decision to establish two experimental Agricultural Vernacular Schools on the Dacca and Chinsurah Farms. The Dacca School started its first session on January 18th, 1920, with a full complement of 30 boys, which, however, dwindled down eventually to 25. All of them are reported to have made excellent progress during the year. The school has now started its final session, which will be completed in December next. Unavoidable delay in building operations postponed the opening of the second school at the Chinsurah Farm until February 1921. A good deal of construction work, *viz.*, workshop, teachers' quarters, etc., still remains to be done. There were 12 students on the roll at the close of the year, recruitment having been hindered by political agitation. Experience up to date has indicated that these institutions as at present constituted are too expensive to be adopted on the large scale that will be necessary if any substantial progress in agricultural education for the masses is to be made. After the close of the year the whole subject of agricultural education was discussed in a conference held at Calcutta and a definite line of policy with regard to the establishment of elementary and higher agricultural schools was drawn up.

Experiments in connection with agricultural instruction are also being made in two schools, *viz.*, at Amarpur Middle English School in Burdwan district and at Durgapur High English School in Chittagong district, both of which are mainly financed by local effort. An Agricultural Officer has been appointed to Amarpur to teach agriculture to the students. Out of 35 boys of the two upper classes who took up the subject of agriculture, 25 passed the examination. The students received both theoretical and practical training. At Durgapur the special class on agriculture, which is intended for those who will take up agriculture as a profession, is reported to be doing well. The course of agriculture laid down for classes VII and VIII failed however to produce satisfactory results, as practically no work in the fields was conducted.

The Agricultural Institute for Dacca, the aims and objects of which were described in last year's report, has received the administrative sanction of Government. Plans and estimates have been submitted, and an area of 300 acres adjacent to the Dacca Central Farm has been acquired. It is intended to commence building operations as soon as funds are available.

Research and Experiment.

The success of an Agricultural Department depends in the first place on the skill and accuracy of its research workers, because without patient and often prolonged preliminary research no improvement in the existing agricultural practice can be expected. Positive results are sometimes a long time in coming, but negative results are often of great value as indicating unprofitable lines of work, and resulting thereby in the saving of much time and energy.

The research of this Department is centred in the Research Laboratories at Dacca and is divided into the Fibres, Botanical and Chemical Sections.

Fibres.—Jute continues to employ the greatest attention from Mr. Finlow as regards Bengal. Other fibres, such as flax, sunn, etc., are however being investigated on behalf of the Government of India.

Kakai Bombai jute is of course well known, but two new races, R. 85 and D. 154, which are, practically speaking, non-chlorotic strains of *Kakai Bombai* have proved slightly better yielders and are now being propagated on an extended scale. Further, 447 single plant cultures were grown against R. 85 as a standard, but two only gave indications that they are worth continuing further. Hybridization has also been undertaken with a view to combining various desirable characters, such as yield, quality, rapidity of growth and freedom from *chlorosis*. One at least of these new hybrids shows great promise. Selection work on *Corchorus olitorius* has resulted in the selection of the variety now known as Chinsurah Green, which has proved its superiority over other races of Bogi jute and is now being propagated on a large scale.

A systematic investigation of *Chlorosis* in collaboration with the Economic Botanist has been commenced with a view to finding out how this

disease can be controlled. A connection between the incidence of this disease and the development of the surface root system has been observed. Research work on the length of ultimate fibres of jute has been renewed and so far plants possessing the longest ultimate fibres have shown inferior yielding power, and hence cross fertilization has been resorted to.

A good deal of work has also been done in the manuring of jute on red soils. Lime and potash are both limiting factors, but are of no practical value, except when used in combination. Good results are then obtained partly because disease is inhibited.

Experiments have now apparently proved that late sowing is essential when seed is required, as the crop is not then so liable to disease.

Water Hyacinth.—The life history and distribution of this pest received a good deal of attention. Much information was collected with regard to its distribution and spread. This will prove of value when concerted action against this noxious weed is decided upon by Government. Isolated attempts at eradication are a mere waste of time and money, because cleared areas rapidly become reinfected from outside. Concerted action over the whole province and also with the neighbouring province of Assam will be necessary. The function of the Agricultural Department can only be advisory.

Botanical Section.—*Paddy* being the main crop of Bengal naturally continues to receive the chief attention of this section.

The survey and selection of varieties suited to the varying conditions of the Province continued on the lines laid down in previous years. Transplanted *aman* and highland *aus* remained under the control of Mr. Hector, while the work on deep water paddies was transferred to Mr. Datta, the Officiating 2nd Economic Botanist.

Three new selections of *aman* are now being tested on a field scale and compare favourably with *Indrasail* as regards yield. One of these, *Dudshar*, is a week earlier than *Indrasail* and may prove very valuable for Western Bengal in consequence. Another, *Tilakhchari*, has a very strong straw and will be used for crossing. Of the new selections under trial *Dudenona* and *Bansmanik* are both very promising and appeared to yield better than *Nagra*, a staple variety in Western Bengal.

The question of early paddies for the high lands of Bankura and Birbhum is also receiving attention.

Work on the inheritance of characters was continued and has indicated that many characters are inherited in groups and not independently. These scientific facts should prove of great assistance to the plant breeder in practice.

Definite results have also been obtained by Mr. Hector as the result of his study of the factors affecting the yield of paddy.

Research work has also been started on the transpiration of rice and experiments are being repeated.

Work on *rabi* crops has now been taken in hand. The work on the cultivated species of *Phaseolus* (Matti Kalai, etc.) remains with the 1st Economic Botanist whilst that on the *Brassicas* (rape, mustard, etc.) has been handed over to the 2nd Economic Botanist. Preliminary work on wheat and masur will also be attempted.

Cotton.—Varieties were again tested in the Botanical Section and also on the four principal farms. Long staple varieties are chiefly under trial, but in no cases were satisfactory yields obtained. Experiments will be continued, but past experience does not raise any great hope that long staple cotton as a rains crop is likely to be a commercial success on a field scale. The moist climate, which induces insect and fungoid attacks and the sodden soils of Bengal, are not suited to this crop. Applications for seed and advice as to how to grow the crop were received in large numbers. Applicants were in every case informed of the somewhat disappointing results of former trials and were advised to confine their sowings to high well-drained land especially to single plants or hedges in the *baris* surrounding the homesteads. It has been decided to initiate experiments with cold weather cotton this year, and a little seed of what is believed to be the old Dacca cotton has been procured with great difficulty.

Chemical Section.—Work on the provincial soil survey has had to be curtailed as this section was very short of staff throughout the year. The

analysis of soils from the newly-opened Government farms is however receiving the immediate attention of the staff.

Sugarcane analysis was carried out on all the Government farms, and a large number of cattle food, manures and fertilizers were examined and experiments were made in order to detect adulteration.

Mr. Pal, the 1st Assistant, carried out an investigation with a view to standardizing a method for estimating potash in soils.

Some very important work on the tobacco crop was started by Mr. Carbery. This work includes an investigation into the manuring of the crop and a study of the various methods of curing and fermenting the leaf with a view to placing the present haphazard methods on a more scientific basis.

Entomology.—The Entomological Assistant was kept fully occupied attending to outbreaks of insect pests all over the Province and in recommending remedial measure. He continued his investigation on the mango weevil and the litchi mite and made a thorough enquiry into the pests attacking the orange trees of the Kalimpong area.

Mycology.—The Mycological Assistant dealt with fungoid diseases and worked in consultation with the Imperial Mycologist at Pusa. The *ufra* disease of paddy continued to receive close attention. It is reported that this disease was less prevalent last year, and this is put down to the great flood caused by the cyclone of September 1919. The standard remedy is stubble burning, but it is also suggested that the disease might be controlled by draining the *bhils*. It is hoped to be able to demonstrate the methods of control of this pest on an extended scale this year, but as in all serious crop diseases and pests the Agricultural Department with its small staff can only indicate the remedies and demonstrate their effectiveness. If complete eradication is to be attempted, remedial methods will have to be carried out very completely and on a large scale if reinfection is to be avoided. Such large scale operation can only be conducted by public bodies such as the District Boards, etc. The staff of the Agricultural Department is far too small, and its functions should be to investigate problems of this nature and work out practical remedies and then to hand them over to the big public bodies for application on a large scale.

Research Station for Western Bengal.—A perusal of the above remarks on research will make it evident that the Dacca Laboratories have been instrumental in bringing about many improvements. The results of investigations at Dacca are, however, mainly applicable to Eastern Bengal conditions as is perhaps only natural. The new varieties have not in every case proved suitable for Western Bengal conditions as the conditions there are very different from those of Eastern Bengal. I am of opinion therefore that a similar but perhaps smaller research station is very urgently wanted to meet the needs of Western Bengal. This applies in particular to plant breeding, though the study of other local problems is also necessary. The Economic Botanist has posted one of his assistants to Chinsurah, but he is greatly handicapped owing to entire absence of laboratory accommodation and other facilities. The Chinsurah Farm is also not entirely suitable as the main problems in Western Bengal are perhaps connected with the high lands, and the provision of better varieties for these areas is very urgent and can only be worked out on the spot.

Agricultural Stations and Farms.—It is hoped to divide the Province into five circles. There should be a central experimental station in each circle at which experimental work of a high order can be conducted in a proper manner. Each district will also have a farm where new varieties of crops and manures will be tested and which will serve as a centre for all agricultural work in the district. One or two farms for the study of special crops, such as tobacco or cane, or of special branches of agriculture such as dairying, are also necessary.

There are at present only two central experimental stations in the Province, namely, at Dacca and Chinsurah. The Presidency Division is very urgently in need of one as there is no Government farm in that Division as yet. In the absence of a properly equipped station for the Northern Circle it has been decided to conduct some experimental work on the Rajshahi Farm as a temporary measure.

With regard to the experimental work at present being conducted, I am of opinion that apart from the Dacca Farm where the standard is satisfactory,

much of it is of a disappointing nature, and compares unfavourably with the experimental work which is being carried out on similar farms in other provinces. Every endeavour is being made to remedy this state of affairs, but it is a somewhat uphill business. A good many members of the staff do not seem to have had a sufficiently thorough training in experimental work.

There are at present nine Government farms, viz., Experimental Farms at Dacca, Chinsurah and Rajshahi, a Tobacco Farm at Burirhat and a Cattle Farm at Rangpur, each in charge of a Farm Superintendent and District Farms at Rangpur, Mymensingh, Comilla and Bogra in charge of the agricultural officers of the district. There are also three private farms at Burdwan, Gosaba (24-Parganas) and Kalimpong under the management of the Department. An account of the work done at each during the year is included in the appendices. Land has been or is about to be acquired for new farms at Barisal, Pabna, Suri, Bankura, Faridpur, Murshidabad, Jalpaiguri and Rangamati in the Chittagong Hill Tracts. Buildings at Barisal have been completed and farm work will soon commence. The construction work at Pabna is just nearing completion and work on the farm has been started. Construction work on other farms will be taken up during the current year if funds permit, but delay is occurring owing to the difficulty in obtaining bricks. The programme for 1921-22 includes a farm for each of the districts of 24-Parganas, Chittagong and Dinajpur. Sites for these have been selected and preliminaries are being arranged.

Cattle-breeding.—Operations were continued on the Rangpur Cattle Farm. This farm was started some years ago as an experimental measure with a view to ascertaining whether it would be possible to raise improved cattle in Bengal instead of depending on importation from upcountry as is the present practice.

To this end the breed is divided into two sections. In one, selected local cows are covered with a Hissar bull and in the other the best local bulls available are used on local cows. The milk yield is carefully recorded for each individual cow, as it is believed that a good milking cow is likely to produce a better progeny than a poor milker.

Selection on these lines is being carried out and the poorer individuals are being rigorously eliminated.

At the same time experiments are being carried out with fodder crops and in the rationing of the herd.

It is still too early to state what the results will be as several generations will have to be bred before definite conclusions can be arrived at. The half-breed Hissar bulls are, however, showing distinct signs of improvement over the local animals.

Rangpur is not an ideal site for cattle-breeding operations as a great part of the farm is liable to be flooded for short periods during monsoon.

The Farm Superintendent was sent for a course of practical training to a Military Dairy Farm with great benefit and he has already, since his return, managed to introduce improvements into the farm routine.

A small dairy herd of red Scinde cattle has been started in connection with the Dacca Agricultural School. Temporary arrangements have been made at present, but it is hoped to construct a small model dairy for educational purpose during the current year.

District work.—Public interest in agricultural matters shows a considerable increase. In the rural areas considerable progress has been made during the year, more particularly in the comparatively few tracts in which we have a reasonable staff. The provision of more staff is an urgent necessity, and a careful enquiry has been made into the possibility of supplementing the limited staff of the Department from extra-departmental sources. It is gratifying to note that such agencies as the khas mahals, court of wards and district boards are now coming to our aid in this direction and it is also hoped that agricultural associations and similar bodies will be able in future to provide trained demonstrators to assist in the propaganda work of the Department.

A brief summary of the demonstration work of the Department is given below, while more detailed accounts are given in the Deputy Directors' reports which are attached as appendices.

Seed distribution.—The scheme for distributing seed of improved varieties which was initiated by Mr. Milligan, when Director, was described

in last year's report. This system has been highly successful in establishing over considerable areas good varieties of jute and paddy, but practical difficulties are now being experienced and it is possible that some modifications may be necessary. In the first place, the demand for seed is far greater than the supply. In the second place, it is found that much of the seed returned at present is too impure to be re-issued as seed. Thirdly, a great deal of the time of our district staff is spent in collecting the seed due, and there are a good many failures to repay. We cannot afford to waste the time of our limited staff on work of this sort. Attention has accordingly been paid during the year under report to the possibility of establishing seed farms for the propagation of improved varieties. The Government farms that are now being established at district headquarters will, it is hoped, serve as an example to the district, but the amount of seed they can produce will of course be infinitesimal compared with the requirements.

It is hoped to gradually form a series of private seed farms through the agencies of khas mahal estates, court of wards, zamindars' co-operative agricultural associations and the like. The advantages of such a system, which has been adopted with success in other parts of India, are obvious. In the first place, the seed is more likely to remain pure. The District Government farm could supply seed to private seed farms where it would be propagated for a further period before distribution to individual cultivators. These would mainly consist of members of agricultural associations based on the seed farm. The seed available in the Government farm would go much further, and the officers of the Department would really be dealing with groups of cultivators instead of with thousands of individuals as at present with a consequent great relief in clerical and accounts work. A system of seed farms of this sort would afford an easy means of introducing rapidly a new variety, and each seed farm in itself would act as an admirable demonstration and educational centre. For perishable seed such as sugarcane the seed farm system would appear to be the only feasible one. A leaflet describing the scheme has been published, and the Chart appended to this report outlines the system.

Already good progress has been made in the organising of these seed farms more. Work has commenced in the Dacca Division, and twelve seed farms are now at work in the Rajshahi and Pabna districts. It is hoped to report in detail on their working next year.

Jute seed.—In spite of the slump in jute the demand for departmental seed was far greater than ever and far more than could be supplied. In Dacca Division, for instance, five thousand maunds of K. B. jute seed was indented for, but only eight hundred maunds were available. No better advertisement of the value of these new varieties could be wished for. As a result of this seed shortage, therefore, it was decided that distribution should, to a great extent, be concentrated as far as possible in the seed producing areas. Village agricultural associations received the preference and, secondly, individual growers who promised to keep their own seed next year. A new development was started whereby certain agricultural associations in Mymensingh district agreed to grow K. B. jute seed for supply to sister associations in Faridpur, as the latter district being low-lying cannot produce its own seed and has to rely on importation from outside each year. This development has required careful organisation and will be followed with interest.

At present the Department is dependent for its supply of jute seed of the new varieties on the planters in Assam and Bihar who grow the seed on contract. This system has the great advantage that the purity of the seed is absolutely assured. Up to the present, zamindars in Bengal has not been prepared to take the method up, but I am glad to be able to report that one or two private concerns in Bengal have now decided to attempt jute seed production this year. Trials are being arranged with a view to ascertaining whether a jute seed crop would not prove a profitable investment on lands too high for paddy in Western Bengal.

Paddy.—*Kataktara aus* was in great demand in Eastern Bengal, where it is now well established over large areas. In parts of the Presidency Division also it proved very satisfactory and it is likely to spread with great rapidity there. As a transplanted paddy *Kataktara*, on account of its earliness,

would seem to be suitable to the high tracts in the extreme west of the province.

As regards *aman* paddy, *Indrasail* continues to assert its superiority over large areas of Northern and Eastern Bengal and is still spreading steadily. A series of careful tests made by the Economic Botanist at Chinsurah indicate that over a series of years it is a heavier yielder than *Nagra*, the best local variety. In years of short rainfall, however, *Nagra* has the advantage. Trials will now be made with *Dudshar*, a heavy yielding variety which is a week earlier in ripening than *Indrasail*.

In Northern and Western Bengal seed was distributed on the old plan whereby an equal amount is returned at harvest time. In Eastern Bengal, however, the seed was sold for cash as the cultivators wished to purchase outright.

Sugarcane.—Many different varieties from many parts of the world have been systematically tested by the Department for some years past. A critical examination of these results was made, bearing in view the important factors such as the yield, purity of juice, freedom from disease, etc., etc., of individual varieties. The *Yellow Tanna* variety stands out pre-eminently as the cane best suited to the varying conditions of Bengal. Most of the old varieties will now be discarded, and although new canes will be tested from time to time, it has been decided to concentrate our immediate efforts on introducing the *Yellow Tanna* variety over as large an area and as quickly as possible. The demand for this cane is very great, but the difficulty is to supply sufficient seed as the seed rate is very heavy. Accordingly a great effort has been made to establish seed farms in the various cane-growing tracts. *Tanna* cane is being grown for seed on an extended area at all Government farms, and it is gratifying to be able to record that a good many zamindars, court of wards and khas mahal estates and agricultural associations have followed our example. The supply of seed available this year was limited and preference was given to individuals or associations promising to start cane seed farms. Next year the amount of seed available will be greatly increased, and the expansion of area under this improved variety should be very rapid.

Whilst it is obvious that the Department cannot go much wrong in rapidly introducing a superior cane of this sort, our future sugar policy as regards other lines of work will have to be decided after considering the recommendations of the Indian Sugar Commission.

Groundnuts.—In the Burdwan Division the cultivation of this crop is expanding. In parts of the Contai subdivision, for instance, the supply exceeded the local demand and the producers were consequently put into touch with Calcutta merchants. This crop should prove well suited to parts of the Presidency Division also. Experimental work on this crop in the past has been somewhat haphazard, and proper variety tests need to be carried out as soon as the district farms are opened.

Wheat.—Pusa 4 and Pusa 12 gave satisfactory results in the Rajshahi Division and should also do well in parts of the Presidency. Selection work on the local varieties which are very mixed was started on a small scale, and this crop which has possibilities of considerable extension will receive more attention from the staff in future.

Tobacco.—Sumatra tobacco is being rapidly extended in Rangpur. The formation of a co-operative purchase society, which could grade the leaf, and so ensure good prices for its members is receiving attention. Encouraging results have been obtained with some of the Burirhat Farm varieties in Mymensingh and other parts of Bengal, and tobacco has now become an item on the demonstration programme.

Owing to the recently imposed tariff on imported tobacco there now appears to be a good chance for introducing the cultivation of high grade tobacco. This is being borne in mind, and detailed experiments have been designed with a view to producing high grade cigarette and cigar tobaccos.

Potatoes.—This valuable food crop is yearly becoming more popular. Owing to the difficulties of transport and wastage it was decided by Government that the departmental sale of seed should be stopped. In Western and Northern Bengal this occasioned no difficulty, as many merchants deal with Darjeeling producers and intending growers are referred to reliable firms and

can secure their seed without great difficulty. In Eastern Bengal where the crop is now rapidly spreading as a result of the demonstration work of the Department, the matter is more difficult because local merchants do not deal in seed potatoes from Darjeeling. It is hoped to solve the problem by persuading agricultural associations to send representatives to Ghoom to purchase seed for the whole association, and a departmental officer will be temporarily posted there to assist during the season.

With a view to improving the variety a large number of seedlings were raised this year and should be productive of good results. The establishment of a potato farm in the Darjeeling district will greatly facilitate matters, as Kalimpong where these new seedlings are now being grown is not very suited to this crop.

Manures.—Castor cake is in great demand as a manure for cane and potatoes and large quantities were sold through the seed stores. Bonemeal as a manure for transplanted paddy is in increasing demand and some enquiries have been received for hyacinth ash as a potash manure. Successful demonstration with dhaincha and cowpea as green manures were carried out in the Northern and Western Circles.

As indicating the possibilities of artificial manuring it may be mentioned that experiments on the red laterite soils of Dacca have shown that over a series of six years by spending an average of Rs. 18 per acre on lime and bonemeal an average increased revenue of Rs. 72 per acre per annum is assured.

Irrigation Experiments.—At a conference of agricultural officers held at Dacca in December last it was decided that an investigation should be made with a view to finding out whether irrigation is likely to be profitable. As a preliminary to this, a rough survey is being made of the areas that are likely to need irrigation and information is also being collected with regard to the forms of water lift locally used, the height of water level, etc.

A preliminary series of experiments were arranged on a small scale. Complete results are not yet to hand, but it may be stated that in certain tracts irrigation shows signs of being profitable. It is hoped to submit the results of this preliminary enquiry in the form of a note in due course.

The practice of re-excavating old tanks has become one of the chief items of work in Birbhum. A few irrigation co-operative societies have been started in Bankura for building and repairing bunds and their progress will be watched carefully with a view to extending the system if successful.

Agricultural Associations and Co-operation in Agriculture.—Considerable progress has been made in the formation of village agricultural associations, and these bodies are serving as useful links between the departmental officer and the cultivator. There are over 200 associations in the Burdwan Division, of which no less than 87 are in the district of Birbhum. In Eastern Bengal over 100 rural associations have been formed, 53 being in Faridpur.

A meeting of representatives of the rural agricultural associations in Eastern Bengal was held on the Dacca Farm in February when the future lines of development of these bodies was discussed. It was agreed that at present they are too loosely organised and want a definite policy. Staff and funds are also necessary in order to ensure that they become permanent in constitution. The starting of association seed farms was recommended as one way of effecting this end and several associations agreed to adopt the suggestion. It will probably be found most satisfactory to register a group of these small rural associations as an agricultural society under the Co-operative Act. This would mean that share capital would have to be raised and each member would therefore have a personal interest in the success of the undertaking. Finance, which has been the rock on which agricultural associations have so often foundered in the past, will be properly looked after because a reserve fund will have to be maintained and the accounts will be properly audited. It will not be possible to attempt the more complicated forms of agricultural

improvement such as irrigation and drainage, joint sale or the purchase of machinery, manures, etc., in this province of small holdings, unless cultivators will agree to combine. The matter is an important one and is receiving considerable attention.

The officers of the Agricultural Department are working with those of the Co-operative Department in several other directions. The Ganja Co-operative Society at Naogaon have successfully demonstrated *Tanna* cane and tobacco and are now contemplating the opening of a demonstration farm. Two irrigation societies have been opened in Western Bengal, and the officers of the Co-operative Department have helped to popularize selected seed in Eastern Bengal. The policy of this department is to keep in the closest possible touch with the co-operative movement.

Agricultural Activities of the Khas Mahal and Court of Wards' Estates and District Boards.—These bodies have continued to give great assistance. Some of them now employ their own officers and by so doing help out the somewhat slender staff of the Department.

An offer of land and a grant have been made by the Jalpaiguri Khas Mahal for a district farm. A demonstration farm has been opened at Paikar in Bogra by the Karatia Wards Estate and land for demonstration farms has been offered by the Bhowal Estate (Dacca), Brahmanbaria and Jessore. The District Boards are now beginning to supplement our staff by officers of their own and are also offering grants for the establishment of farms. Three prominent zamindars in Rajshahi District have set a good example by opening seed and demonstration farms on their estates.

Agricultural Shows.—Fourteen exhibitions were attended during the year under report and a total sum of Rs. 6,182 was contributed by the Department.

An Agricultural Show was held in connection with the Social Service League Exhibition at Dacca in March 1921. The exhibits were excellent with the exception of cattle which were poorly represented. A series of lectures and practical demonstrations were given at the same time.

A show was held on the Rajshahi Farm and was attended by about 4,000 cultivators. I am inclined to think that more real good from the agricultural point of view is done when these shows are held actually on or near the Government farms as the facilities for practical demonstrations are much better.

Indian Science Congress.

This year's meeting was held in Calcutta and I was appointed to preside over the Agricultural section. The Congress was not so well attended as usual, probably because of the dearness and difficulty of accommodation. A large number of papers on various agricultural subjects were discussed.

Provincial Board of Agriculture.

It was not found possible to arrange for a regular meeting of the Board during the year under report. A conference of all the gazetted officers of the Department was, however, held at Dacca in December and several important conclusions were arrived at. The results have been printed.

It is hoped to be able to arrange for a regular meeting of the Board during the rains.

SECTION II.—SERICULTURE.

Work was continued on the lines of previous years under the general control of the Director of Agriculture assisted by the Bengal Silk Committee as an advisory body. The Committee held two meetings during the year. In February last the members of the Silk Committee toured through the silk tracts of Malda and discussed on the spot various suggestions regarding the improvement of the nurseries, extension of

sericultural education, etc. Rai Sahib A. C. Ghosh, First Superintendent of Sericulture, remained in charge of seed production, while Mr. P. C. Chaudhury, the Second Superintendent, conducted research work at Berhampore. Miss Cleghorn, who was appointed as Sericultural Research Expert in September 1920, continued her scientific work on silkworms at Alipore (24-Parganas).

As most of the subordinate appointments of the Sericultural Department are only temporary, it is difficult to secure and retain the services of the right stamp of man. It is very essential therefore that the sericultural staff should be placed on the same footing as the officers of the Agricultural Department as regards prospects and promotion. A scheme for the reorganization of the sericultural establishment is being worked out and will be placed before Government shortly.

District work.—During the year seven Government nurseries were at work. The seed cocoons supplied by the Department are estimated to represent about 29 per cent. of the total seed requirements of the Province and indicate that the Government nurseries have gained the confidence of the public. As a matter of fact, the demand for Government seed is greater than the supply and an increase in the capacity of the nurseries is highly desirable. Steps might be taken in this direction as soon as funds are available.

The total receipts from the nurseries amounted to Rs. 77,286 against Rs. 84,185 of the preceding year. The fall in sale-proceeds is ascribed to severe drought, which badly affected the mulberry crop, and also to an accidental outbreak of muscardine at one of the nurseries. The total expenditure was Rs. 1,40,460.

Cross-breeding Experiments.

Experiments on the hybridisation of indigenous multivoltine races of silkworms, which were started in 1913 with the object of evolving higher silk-yielding varieties, are still in progress. As a result of such hybridisation followed by the direct utilisation or by further selection of the most promising types several multivoltine hybrids are stated to have been fixed. The rearing and testing of these hybrids on a field scale and under village conditions is being continued, but the results are as yet by no means conclusive.

An attempt is now being made to improve the indigenous races by methodical selection on scientific lines and is likely to give good results.

The effect of hill amelioration has been usually attended with satisfactory results.

A model rearing house has been constructed on the most approved lines and its value will be thoroughly tested.

With regard to mulberry, experiments have been initiated to test different varieties and the value of various manures.

Hybridisation work is being carried on by Miss Cleghorn, and the results so far obtained will be found in detail in her report. Her work on the classification of the varieties of mulberry was also continued.

Other work.—As a result of the recommendations made by Prof. Maxwell Lefroy, it was decided to establish a central or Imperial seed supply station at Kalimpong, and the Imperial Protozoologist has started investigations there. A site for the laboratory and the mulberry plantation has been selected, but nothing further could be done for lack of funds.

Sericultural education.—There is an increasing demand for sericultural education in the Malda district, and a school is badly needed there. The existing school at Rajshahi is really too far away to meet the requirements of Malda. Seven boys passed from the sericultural school attached to the research station at Berhampore. Each of these pupils will be given the usual reward of Rs. 250 for the erection of a model rearing house. An Inspector was appointed during the year for the more effective supervision and assistance of ex-students of those sericultural schools.

The primary school at the Piasbari Nursery (Malda), at which the sons of professional rearers are given training in the principles of sericulture, is doing useful work. It is hoped to be able to open more schools of this type in other parts of the silk districts.

SECTION III.—MISCELLANEOUS.

Statistical.—The crop forecasts and other statistical returns were published as usual.

Rainfall.—During the year one new rain-registering station was opened, making a total number of 244 in the Presidency.

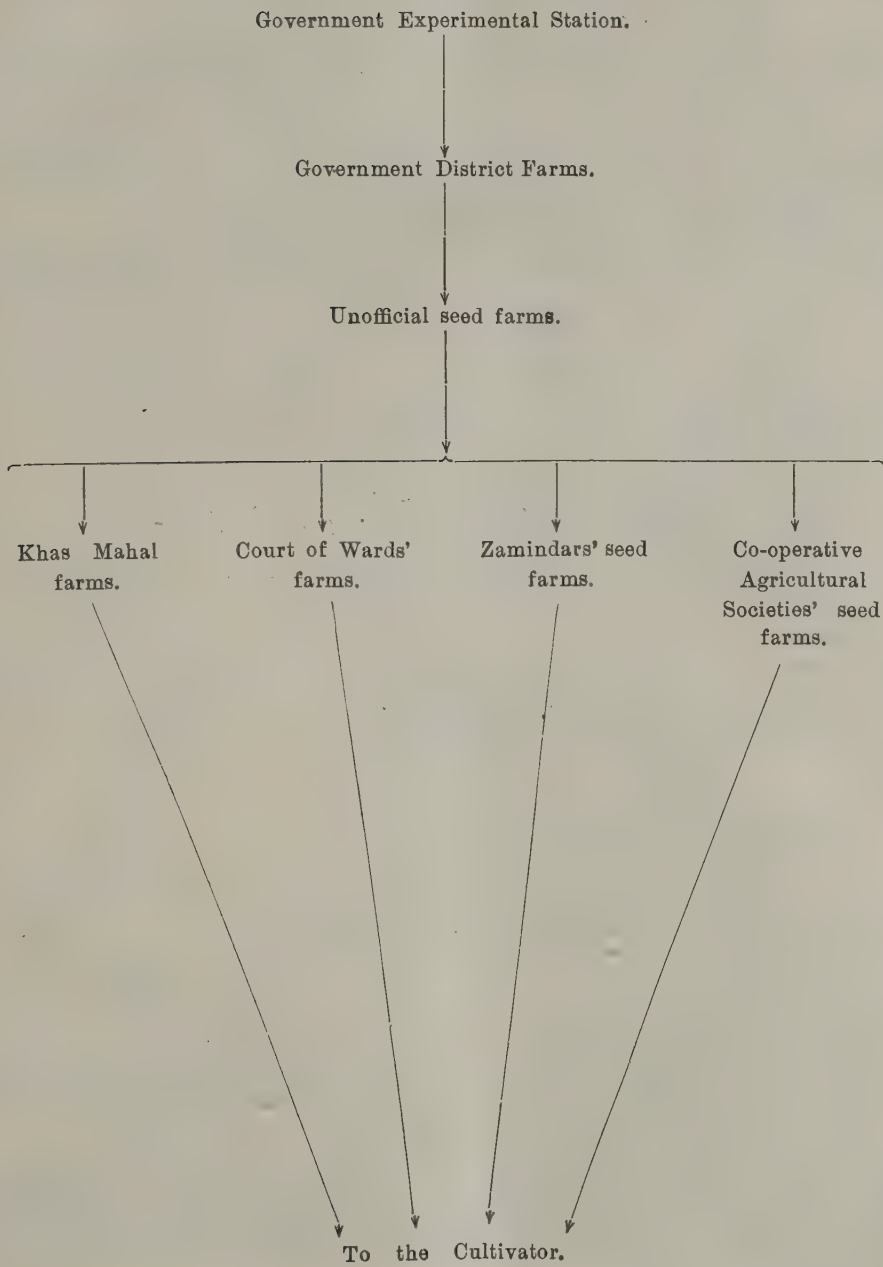
Financial.—The receipts and expenditure of the Department for the year 1920-21 as furnished by the Accountant-General, Bengal, are detailed below:—

RECEIPTS.				EXPENDITURE.			
	RS.	A.	P.		RS.	A.	P.
Receipts on account of experimental cultivation	1,29,310	12	2	Superintendence ...	78,680	6	3
...	...	...	...	Expert staff (other supervising staff) ...	3,67,703	5	6
...	...	...	...	Experimental farms ...	2,30,437	9	5
				Agricultural experiments ...	12,731	12	0
				Seed stores ...	13,718	9	1
				Public exhibitions and fairs ...	2,780	0	0
				Sericulture ...	2,01,394	3	9
				Total ...	9,07,445	14	0

Publications.—With a view to giving wider publicity to the work of the Department and to encourage the spread of agricultural knowledge, it was decided to publish an Agricultural Journal for the Province. This will supersede the annual Year Book of the Department. It will be printed both in English and Bengali and will be issued quarterly in March, June, September and December of each year. The subscription has been fixed at Re. 1-4 per annum, so that it is within the means of most people. The first number of the journal was issued towards the close of the year.

Acknowledgment.—I desire to express my obligations to the large number of both officials and non-officials who have rendered assistance to the Department during the year. Without their active co-operation it would not have been possible to have carried out our extensive programme. I am also indebted to the Imperial officers at Pusa, who have always been anxious to assist.

Staff.—During the year the Expert staff and the Deputy Directors have worked with great energy. The research work, which is being done by Messrs. Finlow and Hector in their respective sections, is of a high order, and in this respect at any rate we can hold our own with other Provincial Departments. Mr. McLean's work in connection with the Dacca Farm and the Publication Committee of the Department has been specially valuable. The Provincial and Subordinate staffs employed in district work and on the farms and laboratories have, with few exceptions, continued to render loyal and useful services. The names of officers specially mentioned for good work will be found in the Circle or Sectional reports. After the close of the year Babu Jamini Kumar Biswas, Superintendent of Agriculture, Dacca Division, received the title of Rai Sahib, a honour which has been thoroughly earned. I have also to acknowledge the excellent work of Rai Sahib A. C. Ghosh, Officiating Deputy Director of Sericulture. He has retired since the close of the year, and his services will be greatly missed in the Sericultural Department, of which he was in charge for over 20 years. I wish to acknowledge the good work of my office staff. The change in Government has resulted in a good deal of extra work, which has been cheerfully carried out. I am especially glad to be able to record the excellent and intelligent assistance that has been rendered by my Personal Assistant, Babu Jyotis Chandra Roy.

Seed Distribution Scheme.

APPENDIX I.

REPORT OF THE DEPUTY DIRECTOR OF AGRICULTURE, WESTERN CIRCLE,
BENGAL, FOR THE YEAR ENDING 31st MARCH 1921.

The Western Circle comprises the two Divisions—Presidency and Burdwan.

I was in charge of this Circle throughout the whole year except for 17 days at the beginning of the year when this area was attached to the Northern Circle. During the period under review I was on tour for 183 days. Mr. N. N. Gupta was Superintendent of the Presidency Division from April to December when Babu K. D. Roy took over charge. They were on tour for 135 and 44 days, respectively. Mr. J. N. Sirkar was Superintendent of the Burdwan Division up to 11th December when Babu C. L. Mustafi took over charge. They toured 124 and 75 days, respectively.

Agricultural officers were employed at Murshidabad (215), Nadia (136), Khulna (92), Jessore (96), 24 Parganas (222), Meherpur (170) and Gosaba in the Presidency Division and at Howrah (161), Hooghly (201), Burdwan (201), Birbhum (288), Sadar, Rampurhat (287), Bolpur (244), Bankura (203), Vishnupur (130), Midnapore (262), and Ghatal (122) in the Burdwan Division. The number of days they were on tour are bracketed against each. The District Board, Hooghly, maintained 2 agricultural officers—1 at Serampore and 1 at Arambagh. In the Burdwan Division, 36 demonstrators were entertained by Government and 16 by District Boards and Wards' estates. In the Presidency Division the corresponding numbers were 14 and 2, respectively. In addition to the above 19 jute forecast clerks were maintained in the Presidency Division while 13 were entertained in the Burdwan Division.

The Chinsura Farm was continued by Government and the Pala Farm by the Maharajahdiraja of Burdwan. There is no farm in the Presidency Division. Two new farms are being opened at Suri and Bankura. Land has been acquired and the erection of buildings has commenced.

A new farm will be opened at Berhampore shortly. The land is available and the buildings are ready to be taken up when money is sanctioned. A site has also been chosen at Baraset.

Character of the season.—The season was fair in the Presidency Division, but in the west of the Burdwan Division the season was late and rains ended very early causing a loss of 6-8 annas in the paddy crop. In the Midnapore district there were heavy floods due to the Cossye and Subarnarekha rivers overflowing.

Demonstrations.—The following definite items of demonstration are being carried out in this Circle, and the area affected is limited chiefly by the inadequate staff at our command :—

- (1) Bonemeal for *aman* paddy in the laterite areas.
- (2) *Dhaincha* green manure for transplanted *aman* paddy in every district.
- (3) Distribution of selected varieties of paddy, e. g., *Kataktara aus*, *Indrasail* and *Nagra aman* and of Chinsura green jute.
- (4) Distribution of *Tanna* sugarcane.
- (5) Introduction of groundnuts on high sandy tracts.
- (6) Use of castorcake as a manure for potatoes and sugarcane.
- (7) Re-excavation of tanks and other means of encouraging irrigation in areas that need it.

(1) *Bonemeal.*—This is becoming popular in Birbhum, Burdwan, Bankura and Midnapore. The great drawback to this manure just now is the high price, which increased from Rs. 40 per ton in 1915 to Rs. 180 in 1920. The price at present has receded to Rs. 90 per ton. The increase was due chiefly to purchases by Japan.

The increased outturn of paddy due to bonemeal is 2-3 maunds per bigha.

(2) *Dhaincha green manure.*—The advantage of this manure is its cheapness. It only cost 6 annas per bigha, and the outturn of paddy is increased by 3-4 maunds per bigha. The practice will require much more demonstration than has been given hitherto. It is necessary to make use of any rainfall in April or May to sow the seed, and the crop must be ploughed under or laddered down when 2 to 3 feet high to prevent it becoming too woody.

(3) Selected varieties of paddy—

- (a) *Kataktara* is giving excellent results in Hooghly and Nadia. In Nadia 850 maunds of seed were produced on seed farms in 1920.
- (b) *Indrasail* does well in districts as far west as Hooghly except in saline tracts where the Patna variety proves superior.
- (c) *Nagra* does well in an area a little further west than *Indrasail* on a slightly higher level than that suited to *Indrasail*.

There is a good supply of *Nagra* and *Indrasail* paddy for seed, but when we demand cash payment on delivery the demand is not so great.

(4) *Tanna* sugarcane gives double the outturn of *gur* of the local varieties of cane in the Western Circle, with the result that this variety is very popular. Hooghly and Bolpur were the two centres this year that were able to provide a good supply of cuttings.

(5) Groundnuts are giving satisfactory returns on areas that formerly grew nothing.

(6) Castorcake as a manure is now becoming so popular in the Western Circle that up to Rs. 10 per maund was paid for this manure for potato cultivation in 1920. This cake is well known in the Serampore subdivision where very big stocks are stored every year at Sheoraphuli and Tarkeswar for potato cultivation. Each agricultural officer now stocks this manure, and if purchasers would intimate their requirements in plenty of time sufficient stock could be stored at a reasonable rate to meet all requirements.

(7) Re-excavation of tanks is now becoming one of the chief items of work in Birbhum. Two irrigation co-operative societies have been formed in Vishnupur in Bankura district for building and repairing bunds for a similar purpose, viz., that of providing a water storage area.

For want of one good irrigation in November 1920 in Birbhum, Asansol and Bankura the paddy crop suffered a loss of 4 to 8 annas.

Demonstration has achieved greater success in the Burdwan Division than in the Presidency Division owing chiefly to the larger staff employed in the former Division. The amount of demonstration depends almost inversely on the number of staff and this affects all district work—agricultural associations, seed stores, exhibitions, work on Court of Wards' estates and Khas mahals. I give the number of staff maintained during the year for ready reference:—

Burdwan Division.

1 Superintendent of Agriculture—

Birbhum	...	3 Agricultural Officers, 16 Demonstrators.
Burdwan	...	1 Agricultural Officer, 7 Demonstrators, of which 3 by District Board.
Bankura	...	2 Agricultural Officers, 3 Demonstrators.
Midnapore	...	2 Agricultural Officers, 16 Demonstrators, 7 by District Board and 1 Khas Mahal.
Hooghly	...	3 Agricultural Officers, 4 Demonstrators—2 Agricultural Officers and 3 Demonstrators maintained by District Board.
Howrah	...	1 Agricultural Officer, 1 Demonstrator.

Presidency Division.

24-Parganas	...	2 Agricultural Officers, 4 Demonstrators, 1 Agricultural Officer at Gosaba.
Jessore	...	1 Agricultural Officer, 1 Demonstrator.
Khulna	...	1 Agricultural Officer, 3 Demonstrators.
Murshidabad	...	1 Agricultural Officer, 1 Demonstrator.
Nadia	...	2 Agricultural Officers, 4 Demonstrators.

From the above it is evident only Birbhum has sufficient staff to do good work.

Thanks to Dr. A. Suhrawardy, District Board Chairman, Midnapore.

Babu Baroda Prosad De, District Board Chairman, Hooghly.

Raja Monilal Singh Roy of Chakdighi, Burdwan, who came to our help in providing further staff, good work was also done in these three districts.

Agricultural Associations.—In addition to the two divisional associations and an agricultural association in every district there are said to be over 200 branch agricultural associations in the Burdwan Division, but the majority of them exist in name only. For an association to be a real live body, it is necessary that some definite work should be done. This demands an intelligent local and active person to act as Secretary, who, in collaboration with the local demonstrator, will arrange for definite work to be done and will arrange for the financing for the purchase of seeds and manure.

In a recent scrutiny I made of agricultural associations in Birbhum, of the 85 reported associations I found about 30 could be classed as active associations, but I would be more than satisfied with the progress we are making if we had twenty doing such good work as the Sultanpur, Rampurhat, Bantia, Mollarpur, Bolpur, Bonegram and Labpur branch agricultural associations. These branch agricultural associations or village associations, in collaboration with the district agricultural association, finance all the work and so ensure quick delivery of goods and timely arrival of seeds, manure and implements at sowing time. This is only possible when sufficient demonstrators are maintained.

The financing of the work is so important that it is well to tackle that part of the problem first. Most of the associations come to grief on the rock of finance. Each association must know how it can provide funds for carrying out work. It is no use depending on free distribution—such free distribution kills all self-help and initiative—and what Government can afford to distribute free an equal quantity of seeds or manure to each cultivator in the country?

A most practical demonstration of the value of self-help has just been given in the Birbhum district where the agricultural associations have financed 400 maunds of *dhaincha* seed for green manuring *aman* paddy, whereas other districts with our help have had great difficulty in financing 20 maunds.

Journals.—The agricultural associations of Birbhum and Bankura published their own journals during the year.

Seed Store.—There is now a seed store and office for the use of the agricultural officer at each district headquarters. The District Board of Hooghly maintains two seed stores in addition at Sheoraphuli and at Arambagh. Each store is becoming better known locally.

Agricultural Education.—The agricultural vernacular school at Chinsura was opened in February 1921 with 15 boys. The school is equipped for 30 boys. The course is for two years, and 15 boys after next year will enter and leave the school each year.

Amarpur Agricultural School.—Agricultural lessons were given to the older boys in this school and practical work was done outside under the supervision of an agricultural graduate.

The buildings and stock for the farm are not yet ready.

The Chilean Nitrate Propaganda helped 17 schools during the year.

Ten demonstrators received training at the Chinsura Farm during the year and 57 Union Board Secretaries from the Burdwan Division received a month's training at this farm in 1920-21.

Farms.—At Chinsura a large area was devoted to Mr. Hector's paddy work while a large supply of *Kataktara*, *Indrasail* and *Nagra* paddies was grown for seed.

A small amount of Chinsura green jute seed was grown under Mr. Finlow's instructions.

At Burdwan *Kataktara*, *Indrasail* and *Nagra* and Chinsura green jute were grown for seed.

Building work has commenced on the two farms of Suri and Bankura and estimates have been submitted for the requisite farm buildings for the farm at Berhampore.

Exhibitions.—Agricultural *melés* were held at Burdwan, Asansol, Birbhum, Hooghly and Gobardanga where we had good sets of exhibits and gave practical demonstrations. These with the exception of Burdwan where political agitation spoiled the show after the first day were very popular and were visited by large number of visitors.

Khas Mahals.—The Jessore Khas Mahal maintained a farm at Jessore which we supervised and for which we prepared the cropping scheme and provided the necessary technical advice.

Agricultural Association Garden.—The Khulna Agricultural Association with the help of advice from the Department maintained a small garden.

Recommendations.—The crying needs of this Circle at the present stage are the establishment of farms in the Presidency Division and an immediate provision of 44 demonstrators in the Burdwan Division and 64 demonstrators in the Presidency Division. With such a staff there would be no need of any jute forecast clerks and each agricultural officer would be fully occupied.

Merits of Officers and acknowledgment.—Mr. J. N. Sirkar, Superintendent of Agriculture, Burdwan Division, worked with his usual zeal till he was transferred in November.

Of the outstanding agricultural officers I must thank Babu Sachindra Krishna Dutt, Agricultural Officer, Bankura; Babu Santosh Behari Bose, Agricultural Officer, Birbhum; Babu Chuni Lal Mustafi, Agricultural Officer, Midnapore; Babu Bon Behari Banerjee, Agricultural Officer, Jessore; Babu V. Roy, Agricultural Officer of Khulna; Babu N. Deb; Agricultural Officer of Burdwan and Babu Sujyoti Nath Chatterji of Nadia, for their energetic support.

I wish to record my thanks to the energetic Commissioner of the Burdwan Division, Mr. J. N. Gupta, and Messrs. Blackwood and Lang of the Presidency Division for taking interest in our work, and giving me every help as well as the following Collectors:—Mr. Lambourne of Birbhum, Mr. Vas of Bankura, Mr. Cook of Midnapore, Mr. Moberley of Hooghly, Mr. Drummond of Burdwan, Mr. Prentice of 24-Parganas, Mr. Fawcus of Khulna, Mr. Henderson of Jessore, Mr. Mitter of Nadia and Mr. Adie of Murshidabad.

The special thanks of the Department are due to Dr. A. Suhrawardy, Raja Monilal Singh Roy of Chakdighi and Babu Baroda Prosad De, Chairmen of District Boards, Midnapore, Burdwan and Hooghly, for the great support they gave us during the year.

F. SMITH,

Deputy Director of Agriculture, Western Circle.

APPENDIX II.

ANNUAL REPORT OF THE DEPUTY DIRECTOR OF AGRICULTURE, EASTERN CIRCLE, FOR THE YEAR 1920-21.

The Eastern Circle comprises the two Civil Divisions of Dacca and Chittagong. The district staff consists of the following :—

- 2 Superintendents at Dacca and Chittagong.
- 10 District Agricultural Officers.
- 45 Demonstrators.
- 51 Jute clerks.

The year under report proved one of comparative prosperity for the cultivators, both the *aus* and *aman* rice crops turning out well. The jute crop again proved to be below the average, chiefly due to the cultivators' sowing on very early rains, which were followed by drought, and to lack of water at retting time. The crop was of poor quality and the average price received by the cultivators was low. The latter do not as yet realize that a wide margin of price now prevails between the different marks, and they are still careless in handling their crop.

Sugarcane on the whole did well, and the increase in area under this crop has been very marked. There has, however, been a big drop in the price of *gur*, and it will be interesting to see what effect this will have on the area planted next season.

Staff.

The staff remained the same as in the previous year, except that an Additional District Agricultural Officer was posted to the Kishoreganj subdivision. Babu Amrita Lal Shome was transferred from the post of Mycological Collector to take over this appointment.

Babu Santi Prosad Sen and Babu Satindra Lal Sen Gupta proceeded to Scotland for further studies, and Munshi Abdul Jalil and Babu Profulla Kumar Das took over the posts of Farm Superintendent, Dacca Farm, and District Agricultural Officer, Mymensingh, respectively. Babu Kali Das Roy, Superintendent of Agriculture, proceeded to the Presidency in place of Mr. N. Gupta, on leave, and Babu Benode Lal Mukherjee took over charge of the Chittagong Division.

During the year the posts of Demonstrators were made permanent and 45 men were appointed after examination.

During the year I visited all the districts in the Circle, spending 101 days on tour.

Farms.

After the serious set-back caused by the cyclone last year the Dacca Farm was brought back into working order. During the busy season the question of labour gave considerable trouble, as the tenants on the land acquired for the institute migrated to Assam, the chief source of labour being thus depleted.

Excellent crops of both *aus* and *aman* paddies were harvested. As usual, great difficulty was experienced in harvesting the *aus* paddy dry, and the usual loss in germinating power of the seed ensued. The difficulty will partly be overcome by the purchase of a threshing machine, which will enable the crop to be threshed quickly and the stacking of wet sheaves avoided.

Very definite conclusions were arrived at with regard to elimination of sugarcane varieties unsuitable to East Bengal. *Yellow Tanna* again proved itself a great disease resister, but J 247, which had given hopeful prospects in the past years, succumbed badly to disease.

Arrangements have been made this year in all the districts to multiply *Yellow Tanna*.

In connection with the school a small herd of Sind cattle was purchased, and they are now located on the farm in temporary quarters. Pending the construction of permanent quarters, they were, in the first place, sent to Rangpur, but they were delayed unduly in transit, and after a short time an attack of Red Water developed there and one cow died. The others, with the exception of one cow, which was unfit to travel, were then despatched to Dacca, where they are now doing well. The cow, which was unfit to travel, was subsequently taken to Dacca, but unfortunately never recovered. These cattle seem admirably suited to Bengal conditions.

Work on the farm has been handicapped by lack of accommodation. The construction of buildings received administrative sanction, but no funds were allotted for construction. This has caused great inconvenience to all the staff at the farm who are at present living in the buildings temporarily repaired after the cyclone. The quarters demolished have not been rebuilt, and the officers without quarters have the burden of keeping up two establishments.

The farms at Mymensingh and Comilla are now both in working order. The Mymensingh Farm has the makings of an excellent farm and should be of great value. Promising crops were grown this year, but it will be some time before the plots level up and become uniform. The farm at Comilla suffers from an insufficiency of high land so that it can practically only be used for paddy work. Difficulties have arisen over

drainage, but it is hoped this will be overcome by cutting a drain into a *khal* some way down the Daudkandi Road.

The buildings on the farm at Barisal have been completed and work will commence this year.

The farms at Faridpur and Rangamati in the Chittagong Hill Tracts have not been commenced owing to lack of funds.

Sites were selected for the farms at Chittagong and Feni (Noakhali).

District work.

The demand for departmental seed continues to be more than we can cope with. Indents were received for over 5,000 maunds of K. B. jute seed for the present year's sowings, but only about 800 maunds were available. The demand for *Olotarius* seed could not be met, as none was produced by the Bihar or Madras growers. *Kataktara* paddy also was in great demand, and unfortunately we were again in the same difficulty, the quantity in stock, some 200 maunds, not meeting a tithe of the demand. The same position arose with regard to *Yellow Tanna* cane, and it has been found necessary to concentrate on multiplication and obtain guarantees from those supplied with cuttings that they will utilize their crop for seed production.

The position with regard to *Indrasail* paddy has reached a somewhat peculiar stage, in that cultivators are anxious to buy the seed outright instead of returning the same quantity at harvest time. It is difficult to discover whether this is due to the cultivator's better financial position or whether he appreciates the value of the seed without any guarantee. The fact remains, however, that he is prepared to buy the seed at a premium for seed purposes, which is satisfactory.

High prices still mitigate against the introduction of manures, but nevertheless there has been slow but sure progress.

The introduction of implements has practically come to a standstill, but it is hoped that as agricultural associations become more stable financially, implements will be purchased and hired out to members.

The use of water-hyacinth as a manure is spreading throughout the Circle, but, in spite of this and of other action taken by the authorities, there seems to be no diminution in the quantity of water-hyacinth in the rivers.

Agricultural Associations.

A meeting of representatives of village agricultural associations was held at the Dacca Farm on February 27th, when the questions of organization and working schemes were discussed. It was decided that, wherever possible, each group of associations should have at their disposal an area of land for experimental and demonstration work and for the multiplication of seed for members. A number of representatives of associations expressed their readiness to establish small farms of this type. There is every prospect of these associations proving very valuable institutions, and when they are placed on a sound financial basis, they should form a medium through which agricultural improvements and knowledge can readily be brought home to the cultivator.

A scheme is being worked out with the Registrar of Co-operative Societies whereby these agricultural associations can be placed on a co-operative basis.

Agricultural Education.

The vernacular agricultural school on the Dacca Farm has now started its second and final session. The progress of the boys has been very good indeed and is a credit to the headmaster and his two assistants. There can be no doubt that an education on the lines of the curriculum laid down is undoubtedly the most suited to boys of the agricultural classes. I personally, however, cannot see how we are to multiply schools of this type over the whole of Bengal. Setting aside the capital cost, which could be reduced considerably by erecting *kutcha* buildings and the stipends to students, the recurring cost cannot be less than Rs. 3,000 per annum. Taking the Dacca district as an example, out of a population of practically 3,000,000 people there are roughly 150,000 boys of the vernacular school-age. Taking 100 boys per school, it means that 1,500 schools would be required for the Dacca district alone with a recurring cost of Rs. 45,00,000.

I have discussed the question with Mr. Griffith, the Inspector of Schools, Dacca Division, and our ideas on the subject are in agreement on these main points. At present we train men as Demonstrators, giving them a minimum training period of one year. These men are of varied intellectual standards, but they must have as a minimum a knowledge of reading, writing and arithmetic in the vernacular. We have come to the conclusion that if the Dacca school was utilized for the training of these men, and if their period of training was extended to a minimum of two years, they would be qualified to conduct classes for the *gurus* in vernacular schools in the thanas to which they would be posted as Demonstrators.

The scheme of school-gardening instituted some years ago by the Education Department failed, because the masters knew nothing of gardening. If, however, each school had a garden attached to it where, under the supervision of the Demonstrator, crops, advocated by the Agricultural Department were grown, the boys would have a practical demonstration of the lessons taught in the class room. Further, at the Demonstrators' headquarters classes could be held for *gurus* and demonstrations carried out to guide them in their conduct of the agricultural classes in their school.

As funds become available, more ambitious schemes may be launched, but it appears to me that we require something to be done immediately with as little cost as possible.

At the Durgapur High English School the agricultural classes continue to be held. As I previously reported, the continuation classes are merely theoretical, and do not fit a student to become a cultivator. In the special class, which consists of four boys, the education given is sound and practical, and the boys taking the class intend making agriculture their profession.

Personal.

In conclusion, the year has produced so many agricultural enthusiasts in this Circle that I do not venture to recommend any individuals. I have to thank the innumerable old and new friends of the Department for the great assistance they have given us.

Of the members of the staff, I have the honour to bring to your notice the continued energy displayed by the Superintendents, Babus J. K. Biswas and Kali Das Roy.

K. MCLEAN,
Deputy Director of Agriculture,
Eastern Circle.

APPENDIX III.

ANNUAL REPORT OF THE DEPUTY DIRECTOR OF AGRICULTURE, NORTHERN CIRCLE, FOR THE YEAR 1920-21.

Introduction.—This Circle consists of the eight districts of the Rajshahi Division with a total area of 18,071 square miles. The Northern part of the Circle consists of the strip of submontaneous country in Jalpaiguri running along the foot of the Himalayas. The remainder forms part of the Gangetic plain. The surface consists of recent alluvium, except in portions of Malda, Rajshahi, Dinajpur and Bogra, which belong to an older and more elevated alluvial formation known as "Barind." The districts of Rangpur, Rajshahi and Pabna abound in *bhils* and swamps, some of which are uncultivable.

Character of Season.—The season was not favourable either for winter paddy or *rabi* crops throughout the Circle. In most of the districts, specially in Rangpur, Rajshahi and Dinajpur, the rainfall was quite insufficient during transplanting season. Though there were good showers in the latter part of August, the heavy downpour of September flooded the fields and destroyed practically the entire late planted seedlings.

The rains in January were beneficial to *rabi* crops, but the showers in February accompanied with hailstorms in some districts did a good deal of damage later on.

Charge and Tours.—Rai Rajeswar Das Gupta Bahadur was in charge of the Circle up to the 14th November, when he went on six months' leave. I was in charge for the rest of the year. The Divisional Superintendent of Agriculture was in charge of the office for the short intervening period. The Rai Bahadur spent altogether 140 days and I spent 76 days on tour in this Circle.

Divisional Charge.—Babu Bhabatosh Dutt was the Superintendent of Agriculture of the Rajshahi Division throughout the whole year. He was out on tour for 211 days in the Division.

Establishment.—During the year there was an Agricultural Officer in each district. In Rajshahi, however, the district work was divided between the Farm Superintendent and the District Agricultural Officer, the former having the charge of the Sadar and the latter of the Natore and Naogaon subdivisions. There were besides 13 Demonstrators on the subordinate staff.

The District Agricultural Officers were constantly on the move in their respective districts.

On account of the rapid development of district work, the provision of additional Agricultural Officers and Demonstrators has become imperative.

Demonstration work done during the year—

- (1) Distribution of improved seeds raised by the Experts,
- (2) Introduction of new crops.
- (3) Introduction of better manures.
- (4) Introduction of improved implements.
- (5) Irrigation experiments on *rabi* crops.
- (6) Supply of seeds from our stores.
- (7) Establishment of district demonstration farms and private farms.
- (8) Demonstrations in the Khas mahal and Wards' Estates.
- (9) Organization of rural agricultural associations and seed farms.
- (10) Organization of agricultural exhibitions.
- (11) Jute forecast.

1. *Distribution of improved seeds raised by the Experts.*—*Indrasail* paddy (*aman*)—Two thousand and sixty-one maunds of *Indrasail* paddy seed were distributed to cultivators on the condition of equal return at the next harvest.

A few demonstrations were also carried out in the cultivators' fields in different districts, to show the superiority of *Indrasail* paddy over the local variety. As stated above, the heavy showers of September damaged some of the plots, specially in the districts of Rangpur, Dinajpur and Rajshahi. The plots not affected by these late showers gave a good result.

Katakara aus paddy.—Forty-six maunds of this paddy were sold to cultivators and demonstrations were also undertaken in Naogaon, Malda, Dinajpur, Jalpaiguri and Sili-guri. In Sili-guri it failed, and this variety is probably not suitable. It gave an outturn equal to the local variety in Pabna. In other districts good results were obtained. It has established itself in Rangpur and hence no further demonstration was made there.

K. B. jute.—Two hundred and four maunds of seed were dealt with. It is proved beyond doubt that K. B. Jute is a better yielder than the local varieties. Comparative

trials have shown that a local *Kakya Bombai* at Serajganj cannot compare favourably with the selected one of the Fibre Expert. The cultivators are now keeping their own seed for next year's sowing. It is believed that more than 80 per cent. of them have kept their own seed.

The weather was not at all favourable for the jute crop during the year, and this told heavily on the crop. However, the results on the demonstration plots were satisfactory, when compared with local varieties, grown side by side.

Yellow Tanna sugarcane.—This variety of cane proved its superiority over all other varieties for its hardness, thickness and greater outturn. The cultivation of this cane is rapidly increasing. There was a demand for 800,000 sets, but about 400,000 sets only could be supplied from the Rajshahi and Dayarampur farms and Burirhat and Bhurarghat centres. Small seed farms are being organized in different centres which will help a great deal in meeting the demand for seed next year.

Wheat.—Malda is the biggest wheat-growing district in the Province. Gangajali, Jamali and Kheri are the local varieties; the first one occupies the greater portion of the area. Pusa No. 4, recently introduced, in Malda gave an increased yield of over one maund compared with Gangajali. Pusa No. 12 gave an average increased outturn of about 1½ maunds in Rajshahi and 2½ maunds in Pabna per bigha over the local variety.

Sumatra tobacco.—The cultivation of this valuable tobacco was introduced in the district of Rangpur by the Department. The Rangpur producers of this tobacco are entirely in the hands of the cigar-makers of Trichinopoly, the only buyers of this type of tobacco.

The recent imposition of an extra customs duty on imported tobacco will, it is hoped, give a new impetus to the cultivation of Sumatra and the finer varieties.

Groundnut.—Groundnut has only recently been tried in Dinajpur and Malda. In the former district the result was indifferent, owing to unbalanced weather, but in Malda the results were fair, giving a better profit than that generally obtained from the Bhadoi crop, grown on similar sandy land.

Introduction of better manures.—Seventy-four maunds of bonemeal were used for demonstrations on *aman* paddy in the laterite area of Bogra and Dhaincha as a green manure for wheat in Malda. Bonemeal gave an increased outturn of 1 maund 32 seers over the local method of manuring with cowdung.

Green manuring with cowpea on tobacco land is being adopted by the cultivators of Rangpur. It gave an increased outturn of at least one maund per acre over the cowdung-manured lands.

In Malda sodium nitrate on mulberry against beel-earth, which is the general manure used, gave an increase of leaves amounting to 18 maunds per acre. The application of beel-earth is very costly when compared with Sodium Nitrate.

Introduction of useful implements.—The following implements were supplied at cost price from seed stores :—

(1) Three-rollered sugarcane mill	...	...	...	2
(2) Gur boiling pans	...	...	...	3
(3) Planet junior hand hoe	...	...	...	2
(4) Meston ploughs	...	..	...	29

Irrigation experiments.—A series of irrigation experiments were arranged in all the districts, to see if *rabi* crops could profitably be grown, and thus to solve the problem of extending the cultivation of *rabi* cereals and pulses.

Except in Malda, the attempt was frustrated by winter rains. Arrangements for taking water levels in wells, twice a month, up to the break of monsoon have also been made in suitable centres.

The results of irrigation experiments on wheat and potato are given below :—

Name of crop.	OUTTURN PER ACRE.			
	Non-irrigated.		Irrigated.	
	Mds.	Srs.	Mds.	Srs.
Darjeeling potato	95	30	160	14
Wheat	11	27½	20	38½

The land in Jalpaiguri and Rangpur remains, even in dry season, moist, and consequently the necessity for irrigation of *rabi* crops is obviated.

Seed Stores.—Each district has now a Seed Store at headquarters under the District Agricultural Officer. The accounts and workings of these stores were regularly checked and inspected by the Superintendent.

The number of Seed Stores in this Circle is shown in the table below :—

No.	District.			Location of Seed Stores.		Maintained by
1	Rangpur	...	...	Demonstration	Farm,	Agricultural Department.
				Rangpur.		
2	Do.	...	...	Lalmohirhat	...	Kasimbazar Ward's Estate.
3	Do.	...	...	Nilphamari	...	District Agricultural Association, Rangpur.
4	Do.	...	...	Gaibandha	...	Ditto.
5	Do.	...	...	Burirhat	...	Ditto.
6	Do.	...	...	Tushbhandar	...	Zamindar of Tushbhandar.
7	Jalpaiguri	...	...	Jalpaiguri town	...	Agricultural Department.
8	Do.	...	...	Alipur Duars	...	Khas mahal.
9	Do.	...	...	Mainaguri	...	Ditto.
10	Do.	...	...	Falakata	...	Ditto.
11	Do.	...	...	Kumergram	...	Ditto.
12	Dinajpur	...	...	Dinajpur town	...	Agricultural Department.
13	Do.	...	...	Parbatipur	...	Janbazar Ward's Estate.
14	Darjeeling	...	...	Siliguri	...	Agricultural Department.
15	Pabna	...	...	Pabna town	...	Ditto.
16	Bogra	...	...	Bogra Farm	...	Ditto.
17	Do.	...	...	Khanjanpur	...	Khas mahal.
18	Do.	...	...	Paikar	...	Karatia Ward's Estate.
19	Rajshahi	...	...	Rajshahi Farm	...	Agricultural Department.
20	Do.	...	...	Nator	...	Ditto.
21	Do.	...	...	Dayarampur	...	Zamindar Sarat Kumar Roy.
22	Do.	...	...	Dighapatia	...	Raja of Dighapatia.
23	Malda	...	...	Malda town	...	Agricultural Department.

The following supply was made from the Seed Stores in the year under report :—

					Mds.	Srs.	Ch.
(1)	<i>Cereals—</i>						
	(a)	Indrasail paddy	...	...	...	2,555	32 0
	(b)	Kataktara paddy	...	...	...	45	28 8
	(c)	Other paddies	...	...	...	4	15 4
	(d)	Maize	...	...	...	9	31 8
	(e)	Joar	...	...	...	1	30 0
(2)	<i>Fibre—</i>						
	(a)	K. B. jute	...	...	...	217	32 12
	(b)	Cotton	...	...	...	1	3 0
(3)	<i>Oilseeds—</i>						
	(a)	Mustard	...	...	...	27	0 0
	(b)	Groundnut	...	...	...	7	12 12
(4)	<i>Rabi cereals—</i>						
	(a)	Wheat, Pusa No. 12	...	...	...	23	12 8
	(b)	Do. „ No. 4	...	...	...	31	34 0
	(c)	Do. Gangajali	...	...	...	38	20 0
	(d)	Do. Jubbulpore	...	...	...	0	24 0
	(e)	Barley	...	...	...	6	20 0
	(f)	Oats	...	...	...	0	17 8
(5)	<i>Rabi pulses, etc.—</i>						
	(a)	Pea	...	...	...	37	20 0
	(b)	Gram	...	...	...	14	10 0
	(c)	Lentil	...	...	...	51	0 0
	(d)	Arhar (Comilla)	...	...	...	2	0 0
	(e)	Khesari	...	...	...	84	0 0
	(f)	Sonamung	...	...	...	0	20 0
(6)	<i>Drugs—</i>						
	(a)	Sumatra tobacco seed	...	...	...	28	tolas
	(b)	Bhengi tobacco seed	...	...	...	50	„

(7) *Fruits—*

(a) Papaya ...	...	...	...	13 tolas.
(b) Mango grafts ...	...	...	...	20 Nos.

(8) *Sugarcane—*

(a) Tanna cuttings	72,000 „
(b) Other varieties	121,650 „

(9) *Vegetables—*

(a) Radish seed	200 tolas.
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Mds. Srs. Ch.

(10) *Manures—*

(a) Bonemeal	69 1 4
(b) Castor cake	12 0 0
(c) Sodium Nitrate	1 14 12
(d) Special sugarcane mixture ...	...	...	...	20 cwt.

Mds. Srs. Ch.

(11) *Green manures—*

(a) Dhaincha ...	...	...	...	13 4 0
(b) Cowpea ...	...	...	...	14 24 0
(c) Sunn hemp ...	...	...	...	7 35 0

(12) *Implements—*

(a) Meston plough ...	...	...	...	27 Nos.
(b) Panjab plough ...	...	...	...	1 „
(c) Monsoon plough ...	...	...	...	1 „
(d) Zigzag harrow ...	...	...	...	1 „
(e) Planet Junior hand hoes ...	...	...	...	3 „
(f) Sugarcane crushing mill ...	...	...	...	2 „
(g) Juice-boiling pan ...	...	...	...	3 „
(h) Seed bins ...	...	...	...	5 „
(i) Pruning scissors ...	...	...	...	1 „

Besides these, the District Agricultural Officers made arrangements for the supply of 500 maunds of seed potato to the cultivators.

Government Farms.

At present there are two properly established District Demonstration Farms, namely at Rangpur and Bogra; their areas are respectively 19·16 and 22·9 acres. The Rangpur Demonstration Farm, which is of several years' standing, is doing very useful work. It originally belonged to the District Agricultural Association, but was made over to the Agricultural Department in 1911.

The Bogra Farm only started work last summer.

The Demonstration Farm at Pabna is just nearing completion. The land (20 acres) was acquired by the District Board of Pabna and made over to the Agricultural Department.

Sites have already been selected for Dinajpur and Mainaguri (Jalpaiguri) Farms, and the areas are about 23 and 30 acres, respectively. The money required for the acquisition of land for Dinajpur Farm will be provided by the District Board there, and the land of Mainaguri Farm is to be made over to the Department by Khas mahal.

The Rajshahi Farm was originally started by the district association, but was subsequently made over to the Department. It comprises an area of 63 acres. It is the only experimental farm of this Division. This farm, like the other two important farms of the Circle, namely, Rangpur Cattle Farm and Burirhat Tobacco Farm, are under the direct control of the Deputy Director, whereas the District Demonstration Farms are under the Divisional Superintendent.

Private Farms.

There are at present 12 private farms which have actually been established by the owners under the advice and instructions of the Agricultural Department. The aims of these farms are practically (1) to show to the neighbouring cultivators and tenants of the owner the use of improved seeds, economic manures and implements, (2) to propagate and arrange for supply of improved seeds grown there, and (3) to show that farming is a profitable concern if properly managed.

The list of such private farms are given below :—

No.	District location of the farm.	Area.	Owned by
		Bighas.	
1	Dighapatia Farm	85	Raja of Dighapatia.
2	Dayarampur	85	Kumar Sarat Kumar Roy of Dighapatia.
3	Bilmaria	41	Major Taylor, Midnapore Zamin-daries Company.
4	Bhutaria (Natore)	35	Khan Bahadur Ersad Ali Khan Chowdhury, M.L.C.
5	Bongram (Rajshahi) (not properly organised yet).	300	Babu Hem Chandra Ray.
6	Aliganj (Rajshahi)	100	„ Bhuban Mohan Ray.
7	Boalia Agricultural Farm (Rajshahi)	80	„ Hem Chandra Gupta.
8	Panchanandpur Dilutola Seed Farm (Malda).	15	A few cultivators of Dilutola.
9	Paikar Farm (Bogra)	80	Karatia Wards' Estate.
10	Dasuria Farm (Pabna)	15	Agricultural Association.
11	Chandpur, just started (Pabna) ...	10	Ditto.
12	Serajganj Agricultural Association Farm.	50	Serajganj Branch Agricultural Association.

Agricultural Associations.

For the more rapid development of our work the necessity of organised bodies was felt, and thus rural agricultural associations are being started, and, where possible, small seed farms are also being established in connection with them.

The list of agricultural associations is given below :—

Name of district.	District associations.	Subdivisional associations.	Rural associations.
Rangpur	1	1	9
Jalpaiguri ... ..	...	...	1
Rajshahi ... ..	...	1	9
Malda	1	...	1
Bogra	1	...	...
Pabna	1	1	8
Dinajpur	1	2	3

The Rangpur District Agricultural Association, the oldest of its kind in the Circle, entertained two Demonstrators throughout the year and one Overseer for three months. It also maintained three Seed Stores, which were constructed from its funds. In connection with the demonstration of Sumatra tobacco it not only helped to bring a greater area under cultivation, but also set up curing sheds, advanced money for fermentation and helped to procure markets for the finished tobacco.

The Malda Association purchased 73 maunds of Darjeeling seed-potato, to meet local demands. The result of potato cultivation, specially with irrigation, has created a good impression among the cultivators.

The Pabna District Agricultural Association is very active. It did much useful work during the year under report. This Association was the means of effecting much useful propaganda work in the interior, and it was through its exertions, helped by the District Agricultural Officer, that so many rural associations were formed. It managed two seed farms in the Sadar subdivision, and the Serajganj subdivision has also started one.

Exhibitions.

In the year under report there were two exhibitions in the Circle—one at Natore, and the other on the Rajshahi Farm. The latter was directly run by the Department for the second year in succession.

The Natore Exhibition was an Agricultural, Industrial and Health Exhibition, arranged by the local public, with the Collector as President. The Agricultural section was organised by the District Agricultural Officer, Natore. The Exhibition was opened by the Collector of Rajshahi, and the prize distribution ceremony was presided over by the Hon'ble Minister of Agriculture.

At the Badarganj Fair a departmental stall with agricultural exhibits was arranged by the District Agricultural Officer, Rangpur.

Khas Mahals.

Jalpaiguri.—There are four tahsils in the Jalpaiguri district—Mainaguri, Alipur Duars, Falakata and Kumergram. Each of the tahsils maintained an Agricultural Demonstrator, and in each tahsil there is a Seed Store placed under the Demonstrator. The activities of the Agricultural Department in Jalpaiguri district are mostly confined to Khas mahals, and the District Agricultural Officer spends the greater portion of his time there.

As in previous years, demonstrations were undertaken. *Indrasail* and *Kataktara* paddies, K. B. jute and Darjeeling potatoes were tried side by side with local varieties. The tenants were furnished with two three-rollered mills on condition that they would use the mills by rotation.

As a result of demonstration six Meston ploughs and two Planet junior hand hoes have been supplied to the tenants.

Darjeeling.—The operations for the improvement of agriculture in the Siliguri Khas mahal are being done by the District Agricultural Officer under the Superintendent of Agriculture's supervision, and those of Kalimpong Khas mahals are being looked after by Mr. Edmunds, Farm Superintendent, Kalimpong (St. Andrew's Colonial Homes).

Malda.—There is only a small Khas mahal at Panchanandapur. It maintained one Agricultural Demonstrator. Useful work was done there during the year under report.

Bogra.—The Joipurhat Khas mahal is in the Bogra district. The Departmental Demonstrator, stationed at Khanjanpur, looked after the agricultural work under the supervision of the District Agricultural Officer, Bogra. A plot of land measuring about 2 bighas has been put under *Yellow Tanna* cane for propagation and will be distributed to the tenants next year.

Court of Wards' Estates.

In the year under report three Wards' Estates received assistance, viz., one in Rangpur, another in Dinajpur and the other in Bogra district.

Rangpur.—The Kassimbazar Wards' Estate in Rangpur maintained a whole-time Demonstrator and a Seed Store at Lalmonirhat. The Commissioner sanctioned Rs. 750 for the agricultural improvement of this estate. *Indrasail* paddy, K. B. jute, potato seed, *Yellow Tanna* cuttings and wheat (Gangajali) seed were distributed by the estate to its tenants.

Dinajpur.—Rupees 500 were sanctioned for agricultural improvement in the Jan Bazar Wards' Estate. The estate maintained a whole-time Demonstrator and a Seed Store at Parbatipur. Demonstrations were made with *Indrasail* paddy, K. B. jute, Pusa wheat No. 12 and bonemeal and seeds; manures and implements were distributed among the tenants.

Bogra.—The Karatia Wards' Estate of Mymensingh has a tahsil at Paikar in the district of Bogra. This estate maintains a whole-time Demonstrator, and has opened a farm of 80 bighas, which was supervised as required by the District Agricultural Officer, Bogra.

The estate distributed 106 maunds of *Indrasail* paddy among its tenants on condition that an equal amount was returned at the next harvest. Three maunds of K. B. jute seed were sold at cost price. *Indrasail* was grown on 12 bighas for the multiplication of seeds.

Miscellaneous.

Jute forecast.—In the year under report 30 jute clerks were entertained for five months to check jute areas in the Circle, and to make crop-cutting experiments to find out the probable outturn.

Distinguished visitors.—In the year under report His Excellency the Governor visited the Rangpur Cattle Farm, Burirhat Tobacco Farm and the Bogra Demonstration Farm.

The Hon'ble Minister of Agriculture visited the Bogra Demonstration Farm and the Dighapatia Farm.

The Divisional Commissioner visited the Rangpur Cattle Farm, Burirhat Tobacco Farm and the Bogra Demonstration Farm.

Collectors visited the farms situated in their respective districts very frequently.

The Imperial Agriculturist visited the Rangpur Cattle Farm once.

The Director of Agriculture and Expert officers, Bengal, visited the farms in this Circle very frequently.

Acknowledgment.—Our thanks are due to all Collectors and Sub-Divisional Officers for rendering ungrudging help, on all occasions.

Our thanks are also due to the Khas Tahsildars, Court of Wards' Managers and Secretaries of different agricultural associations for their assistance and co-operation. Special mention should be made of Babu Harendra Nath Mazumdar, Khash mahal Tahsildar of Maynaguri, and Babu Amarendra Pal Chaudhry, late Secretary, and Babu Jitendra Nath Mazumdar, Joint Secretary to the Pabna Agricultural Association.

Babu Bhabatosh Dutt, the Superintendent of Agriculture, Rajshahi Division, gave untiring assistance to the Deputy Director of Agriculture and discharged his heavy duties satisfactorily.

J. N. SIRCAR,

Offg. Deputy Director of Agriculture,
Northern Circle.

APPENDIX IV.

ANNUAL REPORT OF THE FIBRE EXPERT TO THE GOVERNMENT OF
BENGAL FOR THE YEAR 1920-21.

Charge.

I held charge of the section throughout the year under review. I also officiated as Director of Agriculture from the 1st April 1920 till the 4th July 1920.

Tours.

I spent 153 days on tour and inspected experimental work in connection with jute and other fibres at Government farms and elsewhere in the Presidency. In addition, I have also visited the Provinces of Bihar, the United Provinces, the Punjab and Assam with the object of giving advice in regard to fibre cultivation.

Manures for jute on acid red soils.

Central Mirpur field experiments.—As indicated in previous reports, this investigation has been proceeding, since 1915.

For the sake of convenience, the plan included in the report for 1918-19 is reproduced below.

No green manure and growing a revenue crop each kharif season.				Green manured in the kharif seasons of 1915 and 1917, also in the cold weather of 1920.			
Plot 8.	Plot 7.	Plot 6.	Plot 5.	Plot 4.	Plot 3.	Plot 2.	Plot 1.
NO LIME, NO PHOS PHATE.	LIME AND PHOS PHATE.	NO LIME, NO PHOS PHATE.	LIME AND PHOS PHATE.	NO LIME, NO PHOS PHATE.	LIME AND PHOS PHATE.	NO LIME, NO PHOS PHATE.	LIME AND PHOS PHATE.
				Pathway.			
NO LIME, NO PHOS PHATE.	LIME AND PHOS PHATE.	NO LIME, NO PHOS PHATE.	LIME AND PHOS PHATE.	NO LIME, NO PHOS PHATE.	LIME AND PHOS PHATE.	NO LIME, NO PHOS PHATE.	LIME AND PHOS PHATE.
Plot 16.	Plot 15.	Plot 14.	Plot 13.	Plot 12.	Plot 11.	Plot 10.	Plot 9.
Green manured in the kharif seasons of 1915 and 1917 also in the cold weather of 1920.				No green manure and growing a revenue crop each kharif season.			

N. B.—(a) Diagonally opposite quarters of the series receive identical treatment, i.e., green manure, or no green manure, as the case may be.

(b) Alternate strips receive lime and phosphate as shown in the plan.

(c) The whole area received a general manure containing 40 lbs. nitrogen per acre in 1915, 1918 and 1920; and hyacinth ash, equal to 100 lbs. K₂O 2 per acre in 1918 and 1920.

Jute was grown on these plots in the season 1920 with much the same result as formerly, in regard to the combined action of lime and potash in increasing the yield of jute on soils of which the Dacca Farm is a type. The results also shew, that by itself, potash has little effect. On the other hand, lime without potash has no power to inhibit severe attacks of the fungus *Rhizoctonia* on the crop, the yield and quality of which is thereby seriously impaired. Lime and potash may, therefore, as far as jute is concerned, both be regarded as limiting factors on red soils. For the first time the green-manured plots in this series have shown increased returns over those of plots not so treated. Green manuring on the red soil in East Bengal in the monsoon has not, however, proved a success, and other more promising results in this direction are discussed below.

The following table summarises the results obtained up to date.

Central Mirpur manurial plots.

MANURES.	Plot No.	1915.			1916.			1917.			1918.			1919.			1920.			Total gross value of outturn per acre.
		Crop grown.	Yield per acre.	Gross value per acre.	Crop grown.	Yield per acre.	Gross value per acre.	Crop grown.	Yield per acre.	Gross value per acre.	Crop grown.	Yield per acre.	Gross value per acre.	Crop grown.	Yield per acre.	Gross value per acre.	Crop grown.	Yield per acre.	Gross value per acre.	
Lime and bone in 1915, 1918 and 1920. Green manure in 1915 and 1917 General manure (40 lbs. nitrogen) in 1915, 1918 and 1920. 100 lbs. K ₂ O per acre in 1918 and 1920. MEANS	1	Green manure.	Mds. S.	Rs.	Mds. S.	19 23	117	Mds. S.	...	Rs. A.	Mds. S.	25 23	350	Mds. S.	20 24	73 0	Jute.	15 30	189 0	Rs. 677.3 (Jute 55 maunds 36 seers and 4½ rice 19 maunds 16 seers) from four crops.
	3	Green manure.	...	...	...	16 23	99	...	...	...	...	23 36	327	...	18 24	65 2	...	13 14	180 3
	13	Green manure.	...	...	...	16 2	16	...	...	...	...	24 24	337	...	17 28	62 0	...	15 24	187 3
	15	Green manure.	...	...	...	13 32	83	...	...	...	...	23 25	325	...	19 14	67 12	...	14 16	172 12
	...	Green manure.	...	...	...	16 20	99	...	...	...	...	24 15	334	...	19 5	66 15	...	14 31	177 4
No lime and bone Green manure in 1915 and 1917 General manure (40 lbs. nitrogen) in 1916, 1918 and 1920. 100 lbs. K ₂ O per acre in 1918 and 1920. MEANS	2	Green manure.	12 39	78	7 8	69	...	22 29	80 6	Jute.	3 15	21 8	Rs. 945. (Jute 22 maunds 26 seers and 4½ rice 33 maunds 8 seers) from four crops.
	4	Green manure.	...	...	...	12 24	75	...	...	...	...	7 20	72	...	21 18	75 2	...	5 1	32 0
	14	Green manure.	...	...	...	8 37	51	...	...	...	...	7 29	74	...	25 26	89 13	...	3 36	24 14
	16	Green manure.	...	...	...	8 34	50	...	...	...	...	7 14	70	...	22 32	79 13	...	5 4	32 10
	...	Green manure.	...	...	...	10 34	65	...	...	...	...	7 18	71	...	23 8	81 4	...	4 24	27 12
Lime and bone in 1915, 1918 and 1920. No green manure General manure (40 lbs. nitrogen) in 1915, 1918 and 1920. 100 lbs. K ₂ O per acre in 1918 and 1920. MEANS	5	Jute.	19 4	114	...	12 15	75	...	14 19	32 9	...	22 36	322	...	20 34	73 0	Jute.	14 22	174 10	Rs. 733.1 (Jute 62 maunds 11 seers and 4½ rice 31 maunds 23 seers) from six crops.
	7	Jute.	6 35	40	...	8 7	49	...	14 22	32 12	...	23 10	313	...	22 2	77 3	...	11 34	141 3	
	9	Jute.	22 24	135	...	12 33	77	...	21 36	49 5	...	22 20	303	...	19 36	69 11	...	12 36	154 12	
	11	Jute.	17 14	104	...	6 12	38	...	16 22	37 12	...	22 20	303	...	19 29	69 1	...	12 3	144 14	
	...	Jute.	16 19	99	...	9 37	60	...	16 37	38 0	...	23 2	310	...	20 25	72 3	...	12 33	153 14	
No lime and bone No green manure General manure (40 lbs. nitrogen) in 1915, 1918 and 1920. 100 lbs. K ₂ O per acre in 1918 and 1920. MEANS	6	Jute.	1 2	6	...	0 21	3	...	2 37	6 9	...	0 30	7	...	20 22	71 14	Jute.	1 14	8 9	Rs. 232.2 (Jute 18 maunds 8 seers and 4½ rice 28 maunds 9 seers) from six crops.
	8	Jute.	1 7	7	...	0 21	3	...	5 25	12 10	...	2 28	27	...	19 36	69 11	...	1 32	11 7	
	10	Jute.	13 7	79	...	4 33	28	...	9 34	21 10	...	11 4	109	...	23 22	-82 6	...	5 19	34 14	
	12	Jute.	13 17	81	...	2 29	16	...	9 21	21 7	...	8 10	81	...	21 9	74 4	...	4 2	25 13	
	...	Jute.	7 8	45	...	2 6	12	...	6 37	15 9	...	5 28	56	...	21 12	74 8	...	3 6	20 1	

Thus in six years the limed and no-limed plots have respectively given aggregate yields per acre as follows :—

	Lime and bone.	Value.	No lime or bone.	Value.	Difference.
	Mds. Srs.	Rs.	Mds. Srs.	Rs.	Rs.
Value up to 1918 ...	...	500	...	129	371
Aus rice in 1919 at Rs. 3-8 ...	20 26	72	21 12	75	...
Jute in 1920 ...	12 34	154	3 6	20	...
Total revenue ...	...	726	...	224	...
Total cost of special manure applied in six years.	...	110	...	40	...
Net total revenue per acre in six years.	...	616	...	184	432
Average net revenue per acre per annum.	...	103	...	31	72

In other words, by spending an average of Rs. 18 per acre per annum on manures for six years an average increased net annual revenue of Rs. 72 per acre has been realized or at the rate of 400 per cent. per annum on the money invested in manures.

Seed jute.

General.—There was practically no disease in the seed crop in the year under review and late sowing apparently continues to afford all necessary protection.

(a) *Corchorus capsularis.*—In the last season the arrangements for seed production were unfortunate in two ways. In the first place, sugarcane is at present paying Bihar planters so well that, in spite of a 50 per cent. increase in the prices offered, a less area than usual was devoted to seed jute. Secondly, the bad season further curtailed the area, because lack of rain prevented sowing in some cases. And even where sowing took place, the yield of seed was sometimes seriously reduced. As a result, only about 1,000 maunds of seed were obtained as against nearly 2,000 maunds in the previous year.

The demand for departmental jute seed is increasing in a most satisfactory manner. In the coming season the total sowings of jute in Bengal will again almost certainly show a further decrease as compared with last year; but this, as well as the high price which it is found necessary to charge for it, has not prevented a large increase in the demand for departmental seed, orders for which totalled 5,000 maunds in the Dacca Division alone. This is proof that the cultivator realizes the value of good seed, and that he is willing to pay more for it than for ordinary seed.

It has been pointed out in former reports that the production of jute seed suffers, from very serious disadvantages as compared with most other crops. In the latter, *e. g.*, in grains such as rice or wheat, and also in cotton, the seed is either the commercial staple, for the sale of which the plant is cultivated, or is necessarily, as in the case of cotton, reaped with the commercial staple. On the other hand jute fibre is in the stem of the plant which must be cut long before the ripening of the seed if the fibre is to be of good quality. The raising of jute seed, therefore, has, to a large extent, to be done independently of the fibre crop. In view of such limited facilities for production, it is obvious that if the seed is sold in the ordinary way, it would not be possible to seriously affect the aggregate quantity of jute produced within a reasonable time. Mr. Milligan's scheme of distribution of seed in small packets, under which the cultivator does the last multiplication of the seed himself was, therefore, introduced and has resulted in the cultivation at present of about 200,000 acres of *Kakya Bombai* jute in Bengal, Bihar and Assam. This scheme which has been described in detail in previous reports, will be persevered with and, as always, particular attention will be paid to tracts like Gafargaon (Mymensingh), which annually export a considerable amount of seed to Faridpur and other low-lying tracts which cannot produce their own seed. In this way it is obvious that, indirectly, the efforts of the Agricultural Department can be considerably reinforced. A later development is to place agricultural associations who are producing departmental seed, in Gafargaon for instance, in connection with similar associations in places like Faridpur whose members are obliged to buy jute seed every year. This scheme is only in its inception, and it will be necessary to move slowly at first if it is to be successful; but it has great possibilities. The selling price of departmental seed is now, on account of higher payments to producers, double what it was ten years ago. Nevertheless the value of a crop of seed jute is not nearly so great as that of a fibre crop. It, therefore, remains to be seen whether the measures outlined above will suffice to provide the seed which is required, or whether, ultimately, the price of the seed will not have to be further raised until the revenue from a seed jute crop approaches that to be obtained from a fibre crop.

(b) *Corchorus olitorius*.—Owing to the almost complete failure of the Madras crop, practically no seed of "Chinsura Green" was raised outside the Government farms at Rajshahi and Chinsura.

Single plant cultures.

In the season 1920 there were 447 single plant cultures at Dacca. Most of these were pure line selections being grown against R. 85 as standard; but there were also a number of hybrids. Of the pure lines, only two gave indications of favourable comparison with the standards. It seems probable that the latter, including *Kakya Bombai*, R. 85 and D. 154 approach the maximum of what is at present possible, and their superiority to most other races is very obvious when they are grown side by side with them. This was strikingly shown last season where some of the old races with which this work was originally commenced were again cultivated. Only a very superficial comparison was necessary to realize how great progress has been made in ten years.

Hybrids.

One fixed hybrid was multiplied sufficiently last year to be included in the variety tests in the coming season. Others, at least one of which shows great promise, as far as height is concerned, are in process of multiplication and should come into the tests in the season 1922. The object of these experiments is to concentrate as far as possible the desirable characters of both parents in a hybrid progeny. Such properties include yielding capacity, quickness of growth, freedom from *chlorosis*, length of ultimate fibre, etc.

Chlorosis.

In collaboration with the Economic Botanist a systematic investigation of *chlorosis* has been commenced and the connection of the development of the surface root system with the incidence of *chlorosis* has been confirmed. Attempts are being made to see how far the incidence of *chlorosis* can be controlled, also to what degree its transmission from parent to progeny follows the ordinary Mendelian laws.

Length of ultimate filaments.

In early reports a good deal of space was given to this point, which had to be dropped for a time in favour of selection work, which would result in a plant of heavy yielding capacity. Now that the latter object has, to some extent, been realized, it has been found possible to again take up the work on ultimate fibres. So far the plants which possess the longest ultimate fibres have shown inferior yielding power, and cross-fertilization has been resorted to, with the object of producing a hybrid which is a heavy yielder and whose fibre is composed of ultimate filaments longer than the average. Such a fibre might possess greater tensile strength than one containing short filaments.

Varietal tests.

These tests, in 1920, were practically restricted to the comparison of four races of *Corchorus capsularis*, viz.—*Kakya Bombai*, R. 85, D. 154, D. 101, and with this object in view trials were carried out at—

Rangpur Demonstration Farm.
Rangpur Cattle Farm.
Messrs. Sinclair Murray & Co., Narainganj.
Messrs. Landale and Clark, Serisabari.

The season was, almost throughout, unfavourable. In the beginning there were two long droughts, which not only stunted the growth of the crop, but which incidentally, to some extent on account of the dryness of the soil, neutralized the advantage which a non-chlorotic race has in a normal season. The following are the results:—

DACCA FARM, 1920.

Name of race.	Average of duplicate plots.		Percentage of fibre in whole green plant.	
	Mds.	Srs.	per acre.	
D. 154	18	0		5.1
R. 85	18	25		5.3
<i>Kakya Bombai</i>	19	10		5.2
D. 101	12	5		4.4

The yields are very close and show the considerable superiority of the first three over D. 101. The cause of this is not in the stature of the other races, for D. 101 is, on the average, probably taller than any of them. Its fibre percentage is, however, low and it is therefore, as a fibre-producer, relatively inefficient. *Kakya Bombai* probably owes its first place to a slight unevenness in the testing ground.

MESSRS. LANDALE & CLARK, SARISABARI, 1920.

Name of race.					Yield per acre.
					Mds.
D. 154	...	...	...	...	27
<i>Kakya Bombai</i>	...	...	...	...	25

MESSRS. SINCLAIR MURRAY & CO., GODNALI, NARAINGANJ, 1920.

Name of race.					Average of duplicate plots.	
					Mds.	Srs.
D. 154	...	...	...	...	27	0 per acre.
R. 85	...	...	...	...	22	16 "
<i>Kakya Bombai</i>	...	...	...	...	27	20 "
D. 101	...	...	...	...	15	15 "

It is unfortunate that the figure for R. 85 is not comparable with those of the others, which represent the means of two plots only, whereas that for R. 85 is the average of about 15 plots scattered all over a 2-acre field. In any case the results show that D. 154, *Kakya Bombai*, and probably R. 85, are very close together in their respective yielding capacities, also that all of them, as at Dacca, are much superior to D. 101.

RANGPUR CATTLE FARM, 1920.

Name of race.					Average of duplicate plots.	
					Mds.	Srs.
D. 154	...	...	...	...	26	6 per acre.
R. 85	...	...	...	...	27	13 "
<i>Kakya Bombai</i>	...	...	...	...	25	36 "

Average results over two years.

Taking averages of yields of each race in the years 1919 and 1920 at several different places, we have the following figures :—

Name of race.					Average yield in all experiments over two years, 1919 and 1920.	
					Mds.	Srs.
D. 154	...	...	...	...	23	28
<i>Kakya Bombai</i>	...	...	...	...	22	7
D. 101	...	...	...	...	15	35
D. 136	...	...	...	...	17	33
R. 85	...	...	...	...	22	12

Thus as far as we have gone, it would appear that R. 85 and *Kakya Bombai* are about equal, and that D.154 is slightly better than either. In reality, however, it is probable that R. 85 is nearer to D. 154 in yielding capacity, and that both D. 154 and R. 85 are slightly better than *Kakya Bombai*. The tests will be continued in the coming season. Both D. 154 and R. 85 are non-chlorotic races.

Corchorus olitorius.—It is considered that the definite superiority of "Chinsura Green" over any race at present in our possession was proved in previous year. No varietal tests with races of *Corchorus olitorius* were, therefore, carried out in 1920.

Experiments with jute in other Provinces.—As a result of a discussion with the Director of Agriculture, and the Deputy Director of Agriculture, Northern Circle, in the United Provinces, it was decided to carry out experiments with jute in the low-lying tract known as the Ganja. In this tract there is a lot of land which retains good moisture during the cold weather, and which is liable owing to the rise of neighbouring river Gogra to become water-logged or submerged in the monsoon. Such conditions are of course similar to those existing over large areas of Bengal.

Jute was sown on various types of land in the area and some of the crops were irrigated during the long hot weather, but the majority were not. Some very fine crops were reaped, both *Corchorus capsularis* and *Corchorus olitorius*, and it was demonstrated that paying yields of jute can be obtained without irrigation over a considerable area. Demonstrators from Bengal were employed to show local cultivators the details of cultivation and the extraction of the fibre. Considerable care was taken with the latter by the Shapur cultivators, but the fibre from Rampur Muttra was badly prepared. The result was an excellent demonstration of the advisability of producing good quality fibre, for the Shapur consignment was sold in Calcutta at Rs. 12 per maund, that from Rampur Muttra only realized about half this price. We are much indebted to Mr. Milne of Messrs. George Henderson & Co., and Mr. Moon of Messrs. Sinclair Murray & Co., for the trouble they took in valuing the fibre and in putting it through a comprehensive spinning test.

The trials are being repeated on an extended scale in the coming season.

Sunn Hemp—Crotolaria juncea.—This is a particularly valuable crop to the cultivator. It is of course a crop from which a profitable yield of fibre is obtained, but it is also a legume which, through the agency of its roots, absorbs and accumulates atmospheric nitrogen, and thus benefits the succeeding crop. This is universally recognized by the Indian cultivator, who even sometimes sows sunn hemp when there is little or no chance of its yielding fibre. It is done, for instance, in the Mymensingh district in Bengal where a cold weather variety of sunn is sown and fed off by cattle as a preparation for a valuable crop like jute. This corresponds to some extent to green manuring, but it does not usually involve the loss of a revenue crop, which is generally typical of green manuring, because the land on which the sunn is grown would otherwise probably remain fallow in preparation for jute. Sunn hemp is recognized as a valuable green manure in European agricultural practice in India; but, as there is no yield of fibre, because the whole crop is ploughed in, there is a loss of a revenue crop in the season when the sunn is grown. If the fibre could be taken out and sold, about four-fifths of the crop would still be available as green manure, and we should be in the enviable position of producing a revenue crop and at the same time green manuring the land. The extraction of fibre under such conditions would involve an artificial process, to the elaboration of which considerable attention has recently been given. The investigation would have been justified on the above grounds, but additional reasons have been provided for it in the requests for an investigation which have been made by the Agricultural Departments in the Central Provinces and the Punjab, as well as in the complaints from foreign buyers of some classes of Indian hemp regarding the dirtiness of much of the fibre. These complaints do not apply to Bengal hemp for which there is plenty of retting water, and which is usually put on the market in a clean condition. In the plateau districts of the Central Provinces, however, where the well-known "Jubbulpur hemp" is grown, there is often a shortage of retting water, and the sunn has to be retted in mud holes with the inevitable results that dirty fibre is produced. The same applies to parts of the United Provinces and the Punjab.

The investigation has now progressed so far that fibre has been produced, without the aid of the retting process, which has been very favourably reported on by large European buyers of hemp. The remaining part of the problem is to so order the process of extraction as to enable it to constitute an economic proposition. A successful process of this nature has possibilities of far reaching consequences in a country like India, where organic matter may be regarded as generally deficient in the soil. The nitrogen accumulated by the sunn hemp would of course be very valuable in any circumstances.

Flax (*Linum usitatissimum*).

As is well known, exhaustive experiments carried out at Dooriah, Bihar, between the years 1907 and 1913, showed that flax can be profitably cultivated as a cold weather crop in in Bihar without irrigation. Later experiments have extended this conclusion to Northern Bengal and Assam. At the same time Mr. B. C. Burt's experiments with flax under irrigation at Cawnpur have given yields of fibre more nearly approaching those obtained in Europe than any yet obtained in India.

During the war the flax position became acute. Belgium and Northern France were the first of the flax-producing countries to suffer. Afterwards Russia, which before the war supplied about 80 per cent. of the world's flax, went entirely out of the market, and has remained out since. Great efforts were made in Britain during the war to grow more flax, and these have been successful up to a point. But, in spite of this and of the fact that jute was used to a considerable extent as a substitute for canvas, the price of flax to-day is phenomenal, being still several times what it was before the war.

Notwithstanding the exorbitant price of seed, the profits to be obtained from flax cultivation at the present time are very high. The Cawnpur results have been demonstrated to such good purpose that cultivators in the neighbourhood are now quite willing to grow the crop, and over one ton of seed was despatched in the season which has just come to a close. Cultivators in Northern Bengal, where the conditions are highly suitable for flax, would also grow the crop if there were a good market for the straw. The difficulty is the extraction of the fibre, which is, if really good quality is arrived at, a more delicate and elaborate operation than the Indian cultivator is used to. Moreover, it ordinarily involves a capital outlay in machinery, which he could not afford. The only solution appears to be to establish retteries, either through capitalist or co-operative agency, where fibre will be extracted from the straw grown by the cultivator. Attempts are being made to interest Calcutta firms in this matter.

Flax is also being grown this year as a commercial crop in Bihar and Assam.

It is interesting to note that the abnormal state of affairs in regard to labour has produced its result in the form of efforts to minimize the amount of labour required in the handling of flax. Machines are now available for all the important processes in the history of a flax crop. The pulling and the scutching machines are new and eye-witnesses report their performances to be quite satisfactory. One complete set of machines, including a "puller," "butter," "breaker," mechanical scutcher, and "finisher" has already been ordered for India.

It is not to be expected that prices of flax will always remain as high as they are at present. Even if Russian supplies are not available, Canada, the United States and East Africa are all now producing fibre on an increasing scale. Nevertheless, experimental

evidence shows that good crops of flax can also be produced in India, and there is little doubt that they can still be handled more cheaply here than elsewhere. On the whole, therefore, there would seem to be justification for the belief that flax holds considerable possibilities of profit for the Indian cultivator, provided the problem of extracting the fibre can be satisfactorily surmounted.

Minor Investigations.

Sida.—Trials with this crop were continued at Nagpur and at Cawnpur but without encouraging results. Details of its cultivation under conditions differing from those of Bengal require further study.

Other Investigations.

Other minor items include :—

- (a) The comparison of *Sisal* hemp (*Agave Rigida*) varieties from various sources in regard to the age at which the plant “poles,” the object being to find a basis for selection for the production of a more efficient plant than is available at present.

The equatorial climate and good soil of East Africa are, on the whole, more favourable to the exploitation of *Sisal* than corresponding conditions in India. However, the favourable prices for *Sisal*, which have now prevailed for several years, have enabled one or two Indian *Sisal* estates to do well, and there is a possibility of extension on lands which are, to a considerable extent, unsuited for other cultivation.

- (b) The investigation of various palm fibres with reference to their possibilities for brush-making purposes or as cordage fibres.

Numerous enquiries have been received in regard to palm fibres. These include a very large amount of potentially useful material, most of which is at present wasted. This is even largely true of coir or coconut fibre outside Southern India.

Acknowledgment.

Messrs. Sinclair Murray & Co., Messrs. Landale & Clark and Messrs. R. Sim & Co. continued to render assistance to the Department by carrying out tests with jute varieties at their mufassil agencies. We are much indebted both to the firms and the local agents concerned, especially Messrs. John Luke of Narainganj and Cooper of Sarisabari.

I have pleasure in acknowledging the excellent services rendered during the year by Babus N. C. Basu, M. Sc., Laboratory Assistant, and Tara Nath Roy, Field Assistant. My clerk, Mr. J. C. Bain, has also done good work.

R. S. FINLOW,

Fibre Expert.

APPENDIX V.

ANNUAL REPORT OF THE ECONOMIC BOTANIST TO THE GOVERNMENT OF
BENGAL FOR THE YEAR 1920-21.

From 1st April to July the office was in charge of Mr. K. McLean, Deputy Director of Agriculture, Eastern Circle, and from 1st July to 2nd November Mr. Dwijadas Dutta, Superintendent of Agriculture, held charge. I resumed charge on 2nd November on my return from Pusa. Mr. S. G. Sharangpani, First Assistant, went on long leave on 20th August and proceeded to England to study. Babu Kali Prosanna Roy acted as First Assistant, Babu S. C. Chakravarty as second Assistant, and Babu Jnanendra Mohan Sen was appointed to fill the temporary vacancy created by Mr. Sharangpani. The post of second Botanist was sanctioned from 3rd November 1920, and Mr. D. Dutta was appointed to officiate.

Tours.—Mr. Dutta was on tour for 22 days while he was in charge. I toured for 22 days, and the staff toured for 117 days during the year under review.

Work.—The following were the main items of work in progress.

Rice.—Work on rice at Dacca and Chinsura was continued on the lines of previous years and included—

- (1) The survey and selection of varieties, and study of varietal characters.
- (2) Testing varieties for yield.
- (3) The study of the inheritance of characters on crossing.
- (4) Study of the effect of various controllable factors on the plant characters determining yield.
- (5) Work on transpiration and water requirements.

Survey and selection of varieties.—Both at Dacca and Chinsura, the collections of Eastern and Western Bengal varieties were again grown for study and selection. Three main types are under observation.—

- (1) Transplanted *amans*.
- (2) Highland *aus*.
- (3) Deep water paddies, *aus* and *aman*.

No. (3) has been put in charge of the Second Botanist. The description of types, mainly from the point of view of their economic characters, was continued. The types are being arranged according to their duration, as represented by length of time between sowing and flowering, the shorter duration paddies being grown on the higher situations, the longer on the lower. Search for early types was continued. So far the earliest discovered are a local variety known as *Shaita* and a variety called *Dumai*, both of which flower in Dacca within 2½ months from sowing. These early varieties are being used for crossing with later better-yielding varieties, with the object of obtaining better-yielding early types. Selection of further promising types, both at Dacca and Chinsura, was also continued.

Testing varieties for yield.—At Dacca four varieties have been under trial now for three seasons, viz., *Indrasail* (Dacca No. 1) and three later selections known as *Dudshar*, *Dhepi* and *Tilakkacheri*.

Dudshar and *Dhepi* are types very similar to *Indrasail*, the first about a week earlier, the latter a little later.

Tilakkacheri was selected as a heavy-yielding type with a particularly strong straw.

The results indicate that there is little to choose between them as regards yield. *Dhepi* and *Tilakkacheri* are perhaps slightly heavier yielders, but both are coarser paddies, and *Dhepi* is later, so it is not likely to displace Dacca No. 1. *Tilakkacheri* is valuable on account of its strong straw, for which it was originally selected, and will be used for crossing.

Perhaps the most valuable of the three is *Dudshar*, on account of the fact that it ripens about a week earlier than Dacca No. 1. For this reason it may prove valuable for West Bengal, where it will be tested this coming season.

At Chinsura six varieties were under trial, viz., Dacca No. 1, Chinsura *Nagra*, and four other selected types, known as *Dudenona Sajani*, *Bansmanik* and *Dhabla*.

Indrasail has now been tested for yield against *Nagra* for three consecutive years, under the most stringent conditions possible. The test has consisted of growing alternating strips, 120' x 9', or 0.25 acres, each duplicated 24 times.

The results have been as follows:—

Per cent. yield in favour of—

1918	... <i>Indrasail</i> ,	7.4 (± 1.6)
1919	... <i>Nagra</i> ,	5.1 (± 2.8)
1920	... <i>Indrasail</i> ,	23.2 (± 4.4)

On the average of the three years, *Indrasail* has therefore given 8.5 per cent. (± 2.9) better yield than *Nagra*.

These results confirm previous trials and indicate that on an average of a number of years *Indrasail* is, on the Chinsura Farm, a heavier yielder than *Nagra*. *Nagra*, in

years of short rainfall, has, however, an advantage in that it ripens a week earlier, and types are being sought for, which will combine yield with earlier ripening.

Of the other selected varieties under trial, *Dudenona* and *Bansmanik* appear to be the best, both promising to yield more than local *Nagra*.

Inheritance of characters.—Work on the inheritance of characters was continued, and is yielding interesting results. It has been shown that many of the characters by which varieties differ are inherited in groups or patterns, and not independently. A very interesting case of such gametic correlation has been proved to exist in one variety between the colour in the ligule of the leaf and the colour of the grain.

The ligule colour has been shown to depend on three inter acting factors, all necessary for the production of colour, and the grain colour has been proved to depend on the third ligule factor. When this factor is present, the grain is coloured; when absent, the grain is white.

A large number of crosses between early and late types have also been made, and selected types will be grown the next season to the F_3 generation. It is hoped that some of these may combine good yield with early ripening.

Study of factors affecting yield.—The study of certain controllable factors affecting the characters in the plant which determine yield, has been carried on now for two seasons, and the results obtained are summarized.

The factors studied have been—

- (1) date of sowing and transplanting;
- (2) spacing,
- (3) number of seedlings per hill,
and the effect of these on—
 - (a) tillering;
 - (b) date of flowering;
 - (c) number of grains per tiller;
 - (d) weight of individual grains, and;
 - (e) final yield.

The results have shown—

(1) That spacing has a great effect on the number of tillers and the number of grains per tiller, but almost no effect on the date of flowering or on the weight of the individual grains.

(2) Single-seedling transplantation, as opposed to three seedling, produces slight effect on tillering (the difference being in favour of three seedlings), but a marked effect on the number of grains per tiller. It produces no effect on the date of flowering or on the weight of the individual grains.

(3) That one month's difference in date of sowing and transplanting produces little effect on tillering, but a marked effect on the number of grains per tiller. Like the other factors, too, it produces almost no effect on the time of flowering and no effect on the weight of the individual grains, the late-sown plants simply rushing through their early growth in a shorter period and producing fewer flowers and seeds.

(4) That early transplantation of single seedlings, spaced 12 inches apart, yields most when equal number of plants is considered, but this increase in yield is more than compensated for by the few number of plants when equivalent areas are considered.

Transpiration in rice.—This work was started with the object of determining—

- (1) the amount of water transpired by rice during the growing period;
- (2) the ratio of water lost to dry weight produced;
- (3) the effect on the above of different degrees of soil moisture;
- (4) whether there are differences in the above [(1) and (2)] between different varieties; and
- (5) whether, by suitable manuring, the quantity of water transpired can be reduced without reducing the dry weight produced, *i.e.*, whether the transpiration ratio can be reduced.

The results so far obtained indicate—

- (1) that transpiration is a varietal character;
- (2) the total water lost is markedly affected by the degree of soil moisture; and
- (3) that, for a given variety, the transpiration ratio approximates to a constant for all degrees of saturation.

The experiments are being repeated.

Chlorosis in Jute.—In conjunction with the Fibre Expert, the study of the inheritance of chlorosis in jute has been taken up. During the past season cultures from single plants were under observation, both at Dacca and at Pusa. The cultures grown at Pusa were almost as chlorotic as at Dacca, and seedlings of a few days old showed chlorosis, so there seems no doubt that it is hereditary, and not due to soil. A number of observations were also made on the structure of the roots, in order to determine the connection between the roots and the incidence of chlorosis. Results indicated that the deficiency in surface root formation is an effect of the chlorosis, and not a cause. A number of crosses were also made between chlorotic and non-chlorotic types in order to study the distribution of chlorosis in the subsequent generations.

Rabi crops.—Work on cultivated species of *Phaseolus* and *Brassica* was continued.

This work was carried on at Rangpur and Rajshahi as well as at Dacca, duplicate series of plots being grown at each of these places. The classification and description of the types of *Phaseolus radiatus* (Matikalai) has been continued and a large number differing in mode of branching and habit have been found. It has been noted that the growth and habit of the plants at Dacca are very different from what they are at Rangpur and Rajshahi.

The work on *Brassicas* has been handed over to the second Botanist.

Cotton.—The trial of varieties of cotton likely to prove suitable for Lower Bengal was continued and was in charge of the second Botanist. The season was favourable. As before, Dharwar did best, yielding at the rate of 210 lbs of lint per acre, but this is not sufficient to make it a paying proposition.

Mycology.—Babu Amrita Lal Some held the post of Mycological Collector till 10th August 1920, when he was transferred to Kishoreganj as District Agricultural Officer. Mr. P. C. Kar was appointed Mycological Assistant on 29th September.

During the year Babu Amrita Lal Some was on tour for 34 days in connection with work on *ufra* disease of rice, chillee and groundnut diseases. Mr. Kar was on tour for 48 days in connection with the following work:—

Sugarcane diseases.—*Khagri* and *Dacca Ganderi* were under observation at Charnagardi and Bararchar. *Ganderi*, which was planted in low land, suffered most from red-rot; *Khagri*, a harder cane, grown on higher land, did not suffer at all. The cultivators were instructed to burn diseased canes, not to plant in low-lying fields and to plant only healthy sets.

Orange disease.—"Wither tip" (*Collectotrichum glæosporioides*) of orange was found on trees of all ages at Kalimpong. Deficiency of lime is a possible cause, and experiments to test this were started at the Demonstration Farm.

Chillee disease.—"Dieback" of chillee (*Vermicularia Capsici*) has been found prevalent in parts of the province and experiments in remedial measures have been in progress at Rajbari.

Arecanut Palm disease.—This disease has been under observation at Kishoreganj and Haldibari. Fresh material was collected from Kishoreganj and pure cultures isolated in the laboratory.

Observations on the Dacca Farm.—The following pests were under observation on the farm during the year:—*Fusarium* on cotton; *Rhizoctonia* and *Diplodia* on jute; *Rhizoctonia* on Til and Mung; Smut and red-rot on Sugarcane.

Conference and Exhibitions.—The Mycological Assistant attended the third Mycological Conference at Pusa and also attended with exhibits the exhibitions at Faridpur, Burdwan, Dacca and Chinsura.

Entomology.—Babu Profulla Chandra Sen, Entomological Assistant, was in charge of the section throughout the year.

He spent 142 days on tour, investigating outbreaks of insect pests and recommending remedial measures.

On the Dacca Farm the most important pests observed and dealt with during the year were as follows:—

- Litchi bark borer (*Arbela tetraonis*).
- Litchi mite (*Eriophyes* sp.).
- Mango weevil (*Cryptorhynchus gravis*).
- Mango tree-borer (*Carambycidae*).
- Mango shoot-borer (*Alcides frenatus*).
- Pomelo leaf miner (*Phyllocnistis citrella*).
- Large brown cricket (*Brachytrypes achatinus*).
- Apsychid on gold mohar.
- Cotton Jassid (*Empoasca* sp.).
- Cotton leaf roller (*Sylepta derogata*).
- Rice case worm (*Nymphula depunctalis*).
- Rice Hispa (*Hispa aenescens*).
- Til leaf roller (*Antigastra catalaunalis*).
- Sunn flea beetle.
- Sunn hairy caterpillar (*Utetheisa pulchella*).
- Orange Sunn moth (*Argina cribaria*).
- Mustard Aphis (*Aphis brassicae*).
- 12-spotted Epilachna (*Epilachna dedeco-stigma*).

The mango weevil.—Bagging of young fruits with a view to prevent egg-laying was continued with success. Further investigation on the hibernation of the pest was made. The weevil found in the hole of a dead mango branch after the last mango season was kept confined there alive till the end of November. Afterwards it died. This shows they require better shelter, probably in soil, during the cold months.

The litchi mite.—The pest was kept in check by destroying the affected litchi leaves periodically.

The large brown cricket.—The pest was bad on young jute plants. It was kept in check by pouring kerosinised water in the burrows, which neither makes them come out, or kills them inside.

Exhibitions.—The Faridpur, Burdwan, Dacca and Chinsura Exhibitions were attended with exhibits. Storage of rice mixed with lime (1 seer of lime mixed with 1 maund of

rice), and pulses under a layer of sand (one inch thick) was demonstrated as a preventive of insect attacks. The entomological exhibits were also exhibited at the Rajbari Exhibition.

Training.—Short lessons on general classification of insects, common crop pests and remedial measures, illustrated by magic lantern, were given by the Entomological Assistant to the Dacca Farm schoolboys. They were also given practical training on common entomological operations, such as bagging, handpicking and spraying.

Parcels.—A number of parcels of insect pests were received and reported on.

Note on the jute hairy caterpillar (*Diacrisia obliqua*) was published in the Departmental Agricultural Year Book in English as well as in Bengali.

G. P. HECTOR.

Economic Botanist to the Government of Bengal.

APPENDIX VI.

ANNUAL REPORT OF THE SECOND ECONOMIC BOTANIST, BENGAL,
MARCH 1921.

I took over charge of the office of the second Economic Botanist on the 3rd November 1920. I was on tour for 4 days since I took over charge. The botanical work on oil-seeds, cotton, and deep water *aman* paddies has been made over to me.

1. *Oilseeds* have been grown in the botanical area of the Dacca Farm for some years. For the last two years the same varieties are being grown in the Demonstration Farm, Rangpur, as well. Preliminary notes on the different varieties of mustard, rape and sarson, grown in these two places, have been taken.

2. *Cotton*.—The trial of Dharwar, Buri and Cambodia was continued. The season was highly favourable to the growth of the crop, there being a bright spell of fair weather during the monsoon months and no rain after middle of October, as the following table will show :—

Months.			Number of days.	Number of rainy days.	Rainfall.
June	...	...	30	17	13·8
July	...	...	31	13	12·08
August	...	...	31	17	11·29
September	...	...	30	19	17·27
October	...	...	31	6	6·23
Total	...	...	153	72	60·67

The plants made good growth and were free from insect attacks. The cotton was picked from the last week of October. The Cambodia ripened its fruit much later than Buri and Dharwar. Buri and Dharwar were grown on an area of 46' 6" × 97' 6" each (104 acres) and gave an outturn of 32 srs. 14 chs. and 38 srs. 3 chs. respectively. Buri yielded 7 mds. 35 srs. or 644 lbs. of seed cotton per acre, and Dharwar 9 mds. 7 srs. or 752 lbs., of seed cotton per acre.

Cambodia was grown in a few lines only, so that its outturn could not be compared with that of the other two. With a yield of 210 lbs. of lint Dharwar gave a ginning percentage of 27·85 per acre, the worth of which would not be more than Rs. 55. Cotton cannot apparently compete with other field crops of the country, but experiments will be continued this year.

An attempt will, however, be made to grow cotton as a cold weather crop and a scheme is being devised by the Director of Agriculture next year.

Deep water paddy.—A very large tract of Eastern Bengal and a portion of Northern Bengal also is devoted to this crop, which is therefore of considerable importance from the economic point of view.

About 132 varieties have been collected from the districts of Faridpur and Barisal. These were grown as ordinary transplanted *aman*, and single plants have been selected for sowing during 1921-22. A deep-water plot has fortunately been found in the newly-acquired agricultural institute area, and the different varieties will be grown in the tank of the Dacca Farm and in this new area for detailed study and isolation into pure lines.

D. DUTTA,

Offg. 2nd Economic Botanist to the
Government of Bengal

APPENDIX VII.

ANNUAL REPORT OF THE AGRICULTURAL CHEMIST TO THE GOVERNMENT
OF BENGAL FOR THE YEAR 1920-21.

Charge.—I took over charge of the office of the Agricultural Chemist from Mr. McLean on 3rd December 1920.

Staff.—Mr. G. B. Pal continued as First Assistant throughout the year ; Babu Indubhusan Chatterjee as second Assistant. Mr. S. N. Bose, the Bacteriological Assistant, was transferred as a Circle Officer under the Director of Industries. Babu Surendra Nath Rakhit was temporarily appointed for six month, from 3rd December 1920 to assist in the analyses of sugarcane.

Tours.—I was on tour for 46 days, visiting Narsingdi, Rangpur, Pusa, Rajshahi, Mymensingh, Cox's Bazar, etc., mainly in connection with the inspection of farms, analyses of cane sugar and soil work. The journey to Pusa was to attend the Agricultural Chemists' Conference.

Provincial soil survey.—Owing to insufficient staff this work has had to be much curtailed, and only the soils of the Government farms are now being analysed. It is hoped that these will give some indication as to the nature of the soils of the respective districts in which these farms are situated.

Sugarcane.—In addition to the analyses of the different varieties of sugarcane on Dacca Farm, the work has been extended to include sugarcane at Chinsura, Rajshahi and Dayarampur Farms. Both Chinsura and Rajshahi soils are fairly moist, and the high figures and absence of disease amongst the canes on these farms are probably accounted for by this fact. It is hoped to further extend this work next season, in order that in time comparative figures of sugarcane analyses may be obtained, covering all Bengal.

The following table is the result of analyses of canes of different farms (see Appendix I).

Special work.—During the year Mr. G. B. Pal has been engaged on testing methods for estimation of potash in soils, with a view to adopting a standard method. The work, which is not yet complete, will be carried on in consultation with the Committee appointed at the conference of Agricultural Chemists.

Tobacco.—It is intended to carry out some work in connection with tobacco, in order to place the cultivation and curing of this very important crop on a more scientific basis than it is at present. Preliminary steps have already been taken as regards soil sampling and arranging of manurial experiments on the tobacco farms at Rangpur. The study of the various methods of drying and fermenting of the different varieties of tobacco has also been started.

Bacteriology.—Mr. S. N. Bose has been transferred to the Department of Industries and the work has temporarily been stopped. Babu Indubhusan Chatterjee is being sent to the Imperial Bacteriologist, Pusa, for training, with a view to taking charge of this important section.

Pot culture.—Part of the pot culture house of the Fibre Expert's section has been acquired and work is being begun, with a view to forming a valuable supplement to the chemical analyses of the various soils and fertilizers.

Routine work.—A large number of manures and fertilizers have been analysed during the year and experiments have been tried, in order to detect adulteration in cattle foods. The question of the systematic examination of the value of feeding stuffs is also receiving attention.

M. CARBERY,

Agricultural Chemist to the
Government of Bengal.

APPENDIX I.

Name of the farms.				Sucrose.	Glucose.	Disease.
<i>Dacca Farm—</i>						
Marikul	...	...	...	16.42	2.78	Red Rot.
J. 247	...	...	...	12.89	4.17	Stemborer and Little Red Rot.
Hemza	...	...	...	13.82	2.94	Ditto.
Vendamukhi	...	...	...	13.84	3.04	Ditto.
Yellow Tanna	...	...	...	12.39	2.63	Ditto.
B. 147	...	...	...	12.20	4.17	Ditto.

Name of the farms.				Sucrose.	Glucose.	Disease.
<i>Rajshahi Farm—</i>						
Ratoon Yellow Tanna	...	...	...	15.75	0.81	<i>Nil.</i>
" Striped Tanna	...	...	...	11.85	2.27	Red Rot.
" B. 147	...	...	...	17.10	0.71	"
" Vendamukhi	...	...	...	17.82	0.61	Little Red Rot.
" Gandeari	...	...	...	17.03	0.91	Red Rot and Borer.
Planted J. 247	...	...	...	17.03	0.91	Red Rot.
<i>Dyarampur Farm—</i>						
Ratoon Vendamukhi	...	...	...	16.8	0.61	<i>Nil.</i>
" Yellow Tanna	...	...	...	14.4	0.60	Stunted growth.
Planted Yellow Tanna	...	...	...	15.45	0.32	<i>Nil.</i>
<i>Chinsura Farm—</i>						
Ratoon Yellow Tanna	...	...	...	15.42	1.27	<i>Nil.</i>
" Striped Tanna	...	...	...	13.40	2.22	Red Rot and Borer.
" B. 147	...	...	...	18.15	0.60	Little Red Rot.
Planted Yellow Tanna	...	...	...	13.46	1.39	<i>Nil.</i>
" Striped Tanna	...	...	...	13.90	1.61	Red Rot and Borer.
" Vendamukhi	...	...	...	14.59	1.54	Little Red Rot.

APPENDIX VIII.

ANNUAL REPORT OF THE CHINSURA AGRICULTURAL STATION FOR THE
YEAR 1920-21.

Introduction.—The station was opened in 1908. It is situated just on the west of Chinsura Railway Station and is 3 miles from the town of Chinsura. It is only 38 inches above sea-level, and comprises an area of 210 acres, of which 159 acres are under cultivation now, the rest being occupied by buildings, roads, tanks, jhils, etc. An area of 16 acres has been allotted for the Middle Vernacular Agricultural School, which has been recently opened on this farm, to impart agricultural education to the sons of cultivators.

The farm is well suited for jute, rice (winter rice especially) and sugarcane, but difficulty arises in the lack of irrigation facilities. It has to depend entirely on seasonable showers or the water held up in the ditches, which is not always sufficient. The tanks are dry when water is badly needed for sugarcane. Their thorough excavation is absolutely necessary if a good crop of sugarcane is to be raised. An oil engine pump, set up long ago near the tank in Block C, does not work satisfactorily always, tending to get out of order, and the services of a whole-time mechanic are needed to keep it in proper working order. The drainage scheme of the farm requires serious attention, as experience showed this year that the paddy area could not be drained off when there were abnormal rains in August.

Improvement.—A small area of 6 acres of land on the eastern corner of the farm along the railway lines has been raised, which will enable us to grow sugarcane on a more extensive scale and to try highland experiments.

Objects.—The object of the farm is to ascertain by experiments what crops and manures are suitable for the type of soil existing in the Hooghly district generally, and to produce improved varieties of seeds for distribution.

Soil.—The soil is mostly clay loam and represents the Gangetic alluvium to the west of Hooghly. It is fertile and capable of growing good crops. The following table shows the percentage figures of analyses of the soil and subsoil :—

Rainfall and character of the season.

Months.			Average normal rainfall at Sadar (3 miles off).	ACTUAL FALL RECORDED ON THE FARM.		COMPARISON WITH NORMAL.	
				Rainfall.	Number of days.	Excess.	Deficit.
April	1920 ...	...	2.46	1.59	3	...	.87
May	" ...	...	5.85	5.27	6	...	.58
June	" ...	...	10.56	5.75	9	...	4.81
July	" ...	...	11.28	8.38	13	...	2.83
August	" ...	...	11.64	16.93	11	5.29	...
September	" ...	...	8.40	6.32	12	...	2.08
October	" ...	...	4.09	5.07	6	.98	...
November	" ...	...	0.66	Nil	Nil	...	0.66
December	" ...	...	0.19	Nil	Nil	...	0.19
January	1921 ...	...	0.38	Nil	Nil	...	0.38
February	" ...	...	1.20	2.08	3	.88	...
March	" ...	...	1.58	Nil	8	...	...

The season was not very favourable for *aus*, *aman* or jute. The monsoon was unusually late in arrival and did not really set in until second week of August. The rainfall in February and March allowed preparatory tillage for *aus* paddy and sowing operations could be finished early in May. During the period of growth lack of soil moisture was felt in the early part, but good showers in the latter part generally improved the situation. Owing to long drought in July transplanting has been greatly delayed, with the result that the transplanted *aus* was a failure and the outturn of *aman* paddy was greatly

reduced. Only the heavy rain of the latter part of August and September made it possible to obtain any rice crop at all. Previous to this period the prospects were very disastrous. Taking all these facts into consideration, it is easy to understand the difficulty we had in transplanting the large area of 93 acres of paddy in the short time at our disposal. Late rains, however, proved beneficial to the late transplanted paddy.

Temperature.—The table below shows the average monthly temperatures (maximum and minimum) in Fahrenheit in the open and in shade on the farm for the year :—

Month.	OUTSIDE.		INSIDE.	
	Maximum.	Minimum.	Maximum.	Minimum.
February 1920	75.7	70.7	80.03	63.4
March	107.05	64.3	89.36	66.3
April	100.6	74.9	91.2	80.5
May	93.6	75.1	92.1	83.3
June	99.06	80.3	92.8	84.3
July	91.9	79.7	86.5	81.9
August	89.6	79.6	83.1	81.7
September	91.3	80.1	86.8	82.03
October	92.9	76.6	85.7	79.1
November	91.5	69.0	82.4	73.9
December	82.4	54.2	74.1	63.5
January 1921	81.03	58.0	72.8	64.4

Operations during the year.

- (1) Standardization of plots.
- (2) Varietal test with *aus* paddy.
- (3) Manurial experiment with *Nagra* paddy.
- (4) Seed production—

- (a) *Aus* paddy
- (b) *Aman* paddy.
- (c) Jute.
- (d) Sugarcane.

- (5) Rabi crops (wheat, gram, lentil).
- (6) Other trials—

- (a) Sunn hemp (for fibre).
- (b) Groundnut.
- (c) Rahar.
- (d) Cotton.
- (e) Jowar, maize, etc.

(7) Trials with pure line varieties of paddy were conducted on 18.75 acres of land under the guidance of the Economic Botanist and the results of these experiments will be found in his report.

(1) As in the three previous years the whole of Block A was grown with *Nagra* paddy to test uniformity in order to find out standardised plots. The outturn of the different plots for four years stated below will show that the soils of the different plots were very variable. The table below will show the results of the four years. (*See table annexed.*)

(2) *Aus* paddy (*autumn paddy*).—An experiment was conducted to determine the comparative yield of *Kataktara*, *aus* paddy, local *Gangajali* and *Kele*. The experiment failed on account of late rains.

(3) *Manurial experiment with Nagra paddy*.—The object was to test the value of green manuring with dhaincha as compared with cowdung, castorcake and I. O. P. cake on winter paddy (*Nagra*). The table below shows the different manures applied and the result obtained in each case :—

	OUTTURN PER ACRE.							
	Grain.				Straw.			
	Mds.	Srs.	Ch.	lbs.	Mds.	Srs.	Ch.	lbs.
Dhaincha green manure	34	13	8	2,816	34	36	12	2,864
Cowdung at 100 mds. per acre	26	22	10	2,180	29	39	14	2,459
I. O. P. cake at 6 mds.	25	16	4	2,082	30	1	12	2,464
Castorcake at 6 mds.	27	3	14	2,222	35	10	0	2,890
Unmanured	22	23	0	1,851	26	29	6	2,202

It will be seen from the above table that dhaincha green-manuring gave an outturn of 2,816 lbs. (34 mds. 13 srs.) per acre, topping the list of other manures tried. The superiority of dhaincha green manuring has been definitely established.

The result of the last seven years given below indicate that dhaincha green-manuring when compared with cowdung in almost all cases gives higher yield when favourable weather condition prevails and is the most economical manure for winter paddy :—

Manures applied per acre.	AVERAGE OUTTURN PER ACRE IN MAUNDS (82 lbs.).													
	1912-13.		1913-14.		1914-15.		1915-16.		1916-17.		1917-18.		1918-19.	
	Grain.	Straw.	Grain.	Straw.	Grain.	Straw.	Grain.	Straw.	Grain.	Straw.	Grain.	Straw.	Grain.	Straw.
Unmanured ...	21	30	24	32	14	25	18	23	12	11	21	39	20	25
Cowdung, 100 maunds.	23	37	33	44	17	28	24	27	14	15	27	42	24	32
Dhaincha green manured.	29	46	29	34	18	34	29	36	17	17	33	48	31	46

(4) *Seed Production.*—(a) *Aus paddy (Kataktara).*—14 acres were cropped with selected strains of *Kataktara*. It grew fairly well on broadcasted area, whereas 4 acres of transplanted area was a total failure on account of late rains. An outturn of 1,200 lbs. (15 mds.) per acre was obtained from the broadcasted area.

(b) *Gangajali (local aus paddy).*—This crop was tried on 1.25 acres of land of which .25 acre was broadcasted and one acre transplanted. An outturn of 1,920 lbs. (24 mds.) per acre was obtained from broadcasted area. It gave promise of success. Being late sown, the transplanted area was a failure.

(c) *Aman paddy (Indrasail).*—42 acres of land were put under *Indrasail* for multiplication and supply of pure seeds to the various parts of the province. An outturn of 1,440 lbs. (18 mds.) per acre was obtained. The short outturn is attributable to late rains.

(d) *Hatisal.*—This is a highland paddy; it was grown on 1.72 acres of land. An outturn of 1,200 lbs. (15 mds.) was obtained per acre.

(e) *Jute.*—Green *Olitorius*, was tried on 2 acres of land for seed production. It grew very well and 480 lbs. of seeds were obtained. After the seeds were harvested the stalks were steeped in water and fibre extracted. This gave a total weight of 1,880 lbs. of jute fibre.

(f) *Sugarcane.*—The table below shows the average outturn of ratooned canes of different varieties :—

Names of canes.			Weight of canes, in lbs.	Weight of juice, in lbs.	Weight of gur, in lbs.	Yield per acre.			
						lbs.	Mds.	Srs.	Chs.
1.	Yellow Tanna	...	1,804	1,453	190	7,600	92	7	0
2.	Striped Tanna	...	2,181	1,376	185	7,400	90	10	0
3.	B. 208	...	636	450	65	2,600	31	28	4
4.	B. 147	...	597	431	61	2,440	29	30	0
5.	B. 3412	...	512	342	53	2,120	25	34	2
6.	Shamshara	...	625	415	71	2,840	34	25	6
7.	Dacca Ganderi	...	728	525	79	3,160	38	21	7
8.	Vendamukhi	...	1,444	1,041	148	5,920	72	8	0
9.	Red Mauritius	...	578	328	51	2,160	26	13	10

Yellow Tanna which is the most sturdy variety, less liable to be damaged by jackals and pigs, gives the highest yield of gur per acre (13,680 lbs.), and it has gained great favour among the cultivators all over the province. The increasing demand for *Yellow Tanna* cuttings has been definitely noticed. Arrangements are being made for the extension of the area under this crop during the ensuing year to meet the growing demand.

The results of plant canes will be submitted later on.

(5) *Rabi crops.*—Not yet harvested at the time of report.

(6) *Other trials.*—*Sunn Hemp.*—This crop was grown for fibre on 1.93 acres of land and average outturn of 400 lbs. of fibre per acre was obtained.

A small experiment with sunn hemp was conducted on .15 acres of land, to ascertain at what time it is profitable to harvest it. One plot was cut in the flowering stage and the other when the seeds had properly formed. The joint value of seed and fibre was compared with the fibre cut in the flowering stage. The results are tabulated below :—

Plot I.—Sunn hemp cut in the flowering stage.

Plot II.—Sunn hemp cut when seeds formed.

No. of plot.	Fibre.	Seeds.	OUTTURN PER ACRE.		Total.	REMARKS.
			Value of fibre.	Value of seeds.		
	lbs.	lbs.	Rs. A. P.	Rs. A. P.	Rs. A. P.	
I ...	963	Nil	141 0 0	Nil	141 0 0	Fibre sold at Rs. 12 per maund.
II ...	945	578	126 12 0	35 4 0	162 0 0	Fibre sold at Rs. 11 per maund, seed at Rs. 5 per maund.

It will be seen from the above table that the sunn cut when seeds formed gave more pro fit than the sunn cut in the flowering stage. As the results of one year cannot be tak en as conclusive, the experiment will be repeated next year.

Groundnut.—A trial was made with the following varieties:—(a) Big Japan, (b) Spanish, (c) Pondicherry. Big Japan gave an outturn of 1,018 lbs. per acre, Spanish 690 lbs. and Pondicherry 810 lbs. The heavy soils of this farm are not suited to this crop and hence the low outturn.

Rahar.—A good crop of *rahar* was harvested this year. The Comilla variety was tried and did exceedingly well ; it is yet to be thrashed.

Cotton.—Cambodia and Buri varieties of cotton were tried on .10 acre each. The latter did better than the former, but the outturn was hopelessly poor in both cases. Buri gave an outturn of 140 lbs. per acre, whereas Cambodia only 100 lbs.

Jowar.—A small crop of Jowar was tried, but it did not grow well due to heavy soil and damp climate. This crop is not suited to this tract ; its cultivation will therefore be discontinued.

Maize.—It did not do well.

Fruit Garden.—*Bananas.*—A good many varieties of the famous Rampal (Dacca) bananas were tried on the bank of the tank attached to the office. They grew very well. It is very interesting to note that the suckers of these varieties have a great demand in the locality. During the year under report 189 suckers have been supplied to various places of this district.

Papaya.—The Ceylon and Poona varieties were grown ; both did exceedingly well.

Distribution of seeds.—The following seeds were distributed to the various parts of the Province during the year under report :—

	Mds.	Srs.
(1) Indrasail	162	0
(2) Nagra	284	0
(3) Katakara	166	0
(4) Jhingasail	0	20
(5) Hatisal	0	4
(6) Wheat	0	5
(7) Jute seeds (Chinsura Green)	4	3
(8) Dhaincha Seed	0	20
(9) Castor seed	0	33
(10) Rahar	0	38

1. *Miscellaneous.*—*Cattle.*—There were 52 bullocks on the farm, of which six died of old age. An additional three pairs of bullocks were purchased during the year under report, but the number of bullocks is still short of the actual requirements of the farm. The general condition of the stock was good.

2. *Poultry.*—The Black Langshan and Chittagong breeds were reared. But, owing to the breeds being crossed, the latter has been eliminated, keeping the pure type of Black Langshan only. They are thriving well. There is a good demand for them in the neighbourhood for breeding purposes ; 19 cocks and 14 hens were sold during the year under report. Two cocks and 7 hens are left.

3. *Practical training of young men in agriculture.*—During the year under report sixteen apprentices received practical training at this farm.

4. *Exhibition.*—A complete set of farm exhibits was sent to the Hooghly Exhibition, held from the 9th to 16th March. Practical demonstrations of various water-lifts, imple-ments, winnowing machine, etc., were also given. The work of the farm was much appreciated both by the cultivators and *bhadralog* classes.

CHINSURA AGRICULTURAL STATION.

[illegible]

5. *Visits and Inspections.*—The Director of Agriculture, Bengal, inspected the farm thrice during the year, and the Deputy Director of Agriculture made frequent inspections. The farm was also visited by the Economic Botanist and the Commissioner of the Burdwan Division.

6. *Establishment.*—Babu Kshitish Chandra Guha held charge of the farm throughout the year, assisted by one Assistant Superintendent, three overseers and one clerk.

GOVERNMENT FARM, CHINSURA.

Plot-testing experiment for the years 1917-18, 1918-19, 1919-20 and 1920-21, Block A, area
2 acres each plot.

Lines—	i	h	g	f	e	d	c	b	a	Plot No.
Weight.	Mds. Sr. Ch.	Mds. Sr. Ch.	Mds. Sr. Ch.	Mds. Sr. Ch.	Mds. Sr. Ch.	Md. Sr. Ch.	Mds. Sr. Ch.	Mds. Sr. Ch.	Mds. Sr. Ch.	
1917-18					6 37 0	5 32 0	6 20 0	6 11 0	5 1 0	27
1918-19					3 35 0	4 31 0	4 16 0	5 36 0	6 7 0	
1919-20					3 17 8	3 23 8	4 20 8	5 23 0	5 13 0	
1920-21					2 22 2	3 5 8	3 29 3	2 0 5	2 18 4	
1917-18					6 10 0	6 4 0	6 27 0	6 19 0	6 2 0	26
1918-19					4 34 0	4 29 0	4 25 0	6 5 0	6 19 0	
1919-20					5 30 0	4 36 8	5 11 0	6 11 0	6 0 0	
1920-21					2 34 2	3 31 14	2 35 6	2 14 10	2 4 2	
1917-18					4 35 0	5 33 0	5 38 0	6 22 0	6 2 0	25
1918-19					3 16 0	3 6 0	4 32 0	5 12 0	6 13 0	
1919-20					5 10 12	3 2 8	5 4 8	6 24 8	6 0 0	
1920-21					3 6 12	1 22 12	3 32 14	3 10 4	2 19 2	
1917-18					6 27 0	5 39 0	5 7 0	5 19 0	6 27 0	24
1918-19					3 2 0	3 27 0	3 34 0	2 39 0	4 22 0	
1919-20					4 28 0	5 13 12	4 20 0	4 22 8	5 21 0	
1920-21					3 1 14	2 7 12	3 3 14	2 21 7	3 15 12	
1917-18					5 20 0	Nil	6 32 0	Nil	6 8 0	23
1918-19					3 13 0	3 10 0	5 29 0	2 37 0	5 19 0	
1919-20					3 0 0	4 23 0	5 13 0	4 2 8	4 30 0	
1920-21					3 4 15	3 13 4	2 19 1	2 27 0	3 7 11	
1917-18					5 19 0	4 1 0	6 9 0	5 30 0	5 12 0	22
1918-19					3 24 0	3 13 0	2 11 0	3 19 0	4 15 0	
1919-20					3 21 0	3 21 0	4 33 0	5 23 8	5 29 0	
1920-21					3 23 15	2 32 4	2 25 0	3 14 8	3 34 2	
1917-18					5 39 0	5 18 0	6 4 0	6 7 0	6 35 0	21
1918-19					3 27 0	3 4 0	3 38 0	4 30 0	3 24 0	
1919-20					3 4 12	3 4 12	4 36 0	5 18 0	5 18 0	
1920-21					3 17 6	2 37 2	2 26 0	3 5 2	3 5 8	
1917-18					5 12 0	5 14 0	5 22 0	5 30 0	5 38 0	20
1918-19					3 1 0	3 37 0	4 26 0	5 31 0	3 27 0	
1919-20					4 15 0	4 15 0	5 11 8	3 38 12	5 20 8	
1920-21					2 31 7	4 0 0	2 26 4	3 11 1	3 28 8	
1917-18					5 21 0	5 21 0	5 13 0	4 7 0	6 39 0	19
1918-19					3 9 0	4 15 0	5 35 0	4 2 0	1 37 0	
1919-20					4 8 0	4 36 8	4 34 0	4 39 8	4 0 0	
1920-21					3 25 8	2 30 0	2 22 2	3 10 0	3 20 0	
1917-18					5 20 0	5 19 0	5 20 0	6 7 0	6 23 0	18
1918-19					4 39 0	4 18 0	1 31 0	4 7 0	3 7 0	
1919-20					5 1 0	4 16 0	4 33 8	4 35 8	3 34 0	
1920-21					2 19 7	2 35 2	2 29 6	3 25 9	3 38 14	
1917-18					5 11 0	5 20 0	5 9 0	6 12 0	Nil	17
1918-19					5 12 0	3 1 0	3 4 0	4 18 0	5 28 0	
1919-20					5 4 0	3 10 0	3 27 0	4 17 0	2 8 0	
1920-21					2 4 0	2 33 12	2 18 6	4 0 8	2 37 14	
1917-18					6 1 0	Nil	Nil	6 20 0	6 27 0	16
1918-19					4 32 0	1 23 0	1 17 0	4 23 0	4 30 0	
1919-20					5 15 8	3 4 0	3 11 0	5 10 0	4 12 0	
1920-21					2 29 13	1 25 4	2 20 10	3 31 5	3 30 0	
1917-18					5 27 0	Nil	Nil	6 6 0	6 39 0	15
1918-19					4 24 0	1 17 0	Nil	3 10 0	6 1 0	
1919-20					4 25 0	3 1 0	3 20 0	4 11 0	5 28 0	
1920-21					3 19 10	1 11 2	2 7 0	3 35 13	4 9 8	
1917-18					5 35 0	Nil	Nil	6 1 0	6 11 0	14
1918-19					3 37 0	1 34 0	Nil	3 19 0	5 17 0	
1919-20					4 14 0	4 24 8	4 0 0	3 18 0	5 6 0	
1920-21					3 34 8	3 21 8	4 12 2	3 32 0	4 28 12	

Lites—	i	h	g	f	e	d	c	b	a	Plot No.
	Mds.Sr.Ch.	Mds.Sr. Ch.	Mds. Sr. Ch.	Mds. Sr. Ch.	Mds.Sr. Ch.	Mds. Sr. Ch.	Mds. Sr. Ch.	Mds. Sr. Ch.	Mds. Sr. Ch.	
1917-18	4 37 0	Nil	Nil	4 17 0	6 38 0	5 32 0	Nil	13
1918-19	3 26 0	1 15 0	2 18 0	0 33 0	6 5 0	5 17 0	6 30 0	
1919-20	5 10 0	5 30 12	5 13 0	2 29 0	4 26 0	4 10 2	5 1 0	
1920-21	3 21 0	3 17 0	2 27 8	2 10 4	3 35 13	3 0 6	4 21 5	
1917-18	5 20 0	4 18 0	4 11 0	6 12 0	6 31 0	7 17 0	6 16 0	12
1918-19	3 19 0	1 36 0	1 7 0	4 34 0	4 7 0	6 35 0	6 15 0	
1919-20	4 30 0	3 20 0	3 28 0	5 0 0	4 35 0	6 20 0	5 33 0	
1920-21	3 21 4	2 22 10	2 22 4	3 22 11	3 27 11	4 14 4	3 37 11	
1917-18	5 2 0	4 37 0	4 33 0	6 28 0	6 39 0	7 4 0	6 12 0	11
1918-19	3 4 0	2 34 0	1 1 0	5 6 0	6 2 0	6 16 0	6 0 0	
1919-20	4 13 0	4 9 0	3 27 0	5 21 0	6 5 0	6 19 0	5 25 0	
1920-21	3 20 8	3 0 4	2 13 9	3 36 13	3 33 11	3 12 0	4 4 11	
1917-18	6 11 0	4 32 0	6 20 0	6 26 0	6 35 0	7 13 0	6 29 0	10
1918-19	3 27 0	3 10 0	4 7 0	5 5 0	5 38 0	6 7 0	6 1 0	
1919-20	4 14 0	4 10 0	3 35 0	5 31 0	6 10 0	6 27 0	6 12 0	
1920-21	3 27 8	3 2 6	3 9 14	3 36 7	3 27 6	3 6 0	3 7 9	
1917-18	5 18 0	6 11 0	6 29 0	6 9 0	5 39 0	6 21 0	6 12 0	9
1918-19	4 10 0	4 32 0	4 36 0	4 18 0	2 30 0	6 13 0	5 39 0	
1919-20	5 0 0	3 31 0	5 31 0	5 3 0	6 33 0	6 18 0	6 8 0	
1920-21	3 37 10	3 3 8	4 3 6	3 23 1	2 18 10	2 36 6	3 30 3	
1917-18	Nil	6 29 0	Nil	5 17 0	Nil	5 38 0	5 36 0	8
1918-19	3 0 0	5 35 0	5 7 0	4 20 0	5 33 0	6 33 0	5 29 0	
1919-20	3 23 0	5 2 0	4 34 0	5 8 0	5 30 8	5 37 0	5 8 0	
1920-21	2 19 12	3 8 14	2 28 14	3 8 4	1 19 14	2 27 4	1 21 10	
1917-18	5 23 0	5 37 0	6 0 0	6 12 0	6 4 0	5 39 0	5 17 0	7
1918-19	4 28 0	6 6 0	6 14 0	5 8 0	5 17 0	6 6 0	5 13 0	
1919-20	5 28 0	5 20 0	5 26 0	5 15 0	5 35 0	4 27 0	5 19 2	
1920-21	4 17 8	4 35 4	4 15 1	3 38 0	2 26 10	1 37 6	3 7 9	
1917-18	5 31 0	5 34 0	6 6 0	6 14 0	5 37 0	5 36 0	3 8 0	6
1918-19	5 3 0	6 6 0	6 27 0	5 23 0	5 36 0	6 8 0	5 17 0	
1919-20	5 38 0	5 15 0	6 6 0	5 23 0	5 23 6	5 29 0	5 7 9	
1920-21	4 2 7	3 39 3	3 14 14	3 27 5	2 16 1	2 18 15	3 1 1	
1917-18	6 9 0	5 38 0	6 11 0	6 15 0	6 2 0	5 38 0	5
1918-19	5 33 0	6 25 0	5 15 0	6 18 0	6 12 0	5 39 0	
1919-20	6 1 0	5 22 0	4 38 0	6 4 0	5 11 0	5 19 0	
1920-21	3 31 11	4 10 10	2 15 1	3 20 6	2 19 7	3 5 2	
1917-18	5 24 0	6 13 0	5 25 0	5 37 0	5 35 0	4
1918-19	6 6 0	4 38 0	8 38 0	6 7 0	5 36 0	
1919-20	5 10 13	4 39 2	5 23 13	5 22 7	5 15 4	
1920-21	3 31 12	3 37 6	3 37 15	2 16 8	3 9 1	
1917-18	4 22 0	Nil	5 8 0	5 2 0	5 2 0	3
1918-19	4 6 0	4 24 0	6 0 0	5 31 0	5 31 0	
1919-20	4 15 12	4 32 0	5 13 8	4 38 5	4 38 5	
1920-21	3 11 11	2 3 15	3 29 2	3 14 5	3 14 5	
1917-18	5 13 0	5 36 0	5 11 0	5 11 0	2
1918-19	6 3 0	5 34 0	5 9 0	5 9 0	
1919-20	4 4 0	5 22 0	4 19 0	4 19 0	
1920-21	3 7 14	2 26 10	2 32 6	2 32 6	
1917-18	5 16 0	5 16 0	1
1918-19	5 23 0	5 23 0	
1919-20	4 32 0	4 32 0	
1920-21	3 15 14	3 15 14	

APPENDIX IX.

ANNUAL REPORT OF THE BURDWAN FARM FOR THE YEAR 1920-21.

The farm is situated at a distance of about four miles south-east of the Civil Station of Burdwan. It was opened in the year 1885, and is the oldest farm in Bengal. It is owned by the Hon'ble Maharajadhiraja Bahadur of Burdwan who bears the expenses of the farm.

During the year under report the scarcity of labour and the demand for high wages by the labourers have told heavily on the working and also on the financial condition of the farm. The farm having no fencing whatsoever, the crops were much damaged by stray cattle and wild animals. The presence of innumerable field rats was a source of great trouble in storing the farm products. The sanitary condition of the farm is not so satisfactory owing to the proximity of jungle and of a Muhammadan graveyard. Thorough repairs have been done to the farm buildings during this year.

Area.—The total area of the farm is 32 acres, of which about 25 acres are under cultivation.

Soil.—The soil is a poor sandy-loam. The analysis of the soil given below shows that it is much deficient in nitrogen, phosphoric acid and lime, but fairly rich in potash:—

				Soil, first 9 inches.	Sub-soil second 9 inches.
Insoluble silicate and sand	...	...	...	88.52	87.47
Ferric oxide	...	...	...	3.60	3.68
Alumina	...	...	...	4.42	5.27
Lime	...	...	...	.34	.33
Magnesia	...	...	...	.34	.31
Potash	...	...	...	.31	.32
Soda	...	...	...	.09	.07
Phosphoric acid	...	...	...	.02	.03
Sulphuric acid	...	...	...	.01	.01
Carbonic acid	...	...	...	.04	.06
Organic matter and combined water	...	...	...	2.31	...
Available potash	...	...	...	.04	.02
Available phosphoric acid	...	...	...	.002	.001
Nitrogen	...	...	...	.001	.007

Irrigation and Drainage.—The Eden Canal runs along the farm on the south of it affording ample facilities for irrigation, without which it would perhaps be impossible to grow crops like sugarcane, potato and sometimes even paddy. On account of the close proximity of the canal and the slope of the ground, the natural drainage of the farm is very good, but when the water in the canal rises above the farm level, it then becomes a source of great trouble as there is no other means of drainage. During the year the farm suffered much from the ingress of the canal water through the numerous holes in the bund.

Season.—The following table shows the rainfall during the year. The season was not so favourable for paddy as the late showers delayed the transplantation, and the total failure of rain in the later parts told heavily on the yield of late transplanted crop:—

Months.				Actual rain- fall in in- ches during 1920-21.	Actual num- ber of rainy days during 1920-21.	Normal rain- fall of 40 years.	Rainy days of 40 years.
April	1920	...	...	0.80	3	2.20	3
May	"	...	...	4.22	4	5.56	6
June	"	...	...	8.55	13	10.70	12
July	"	...	...	7.39	24	12.32	15½
August	"	...	...	12.85	17	11.49	15
September	"	...	...	9.83	11	8.59	11
October	"	...	...	5.09	7	3.93	4
November	"	...	...	Nil	Nil	0.64	¾
December	"	...	...	Nil	Nil	0.13	¼
January	1921	...	...	0.97	2	0.38	¾
February	"	...	...	0.02	1	0.89	1½
March	"	...	...		

Operations of the year:—

- (1) Experimental work.
- (2) Production of improved seeds.

(1) Experiments with the following crops were taken up during the year :—

(a) Paddy.	(f) Gram.
(b) Jute.	(g) Pea.
(c) Cotton.	(h) Mustard.
(d) Rahar.	(i) Linseed.
(e) Potato.	

Aus-paddy.—*Kataktara* and local *Newali* were compared for the first time on the farm. Nothing can definitely be said about the superiority of the local *aus* paddy unless it is tried for some years more. But the results obtained this year are greatly in favour of the local variety. The results obtained are given below :—

Name of variety.		Yield of grains per acre in lbs.	Yield of straw per acre in lbs.
<i>Kataktara aus</i> paddy	...	2,278	3,348
<i>Newali aus</i> paddy	...	3,094	4,282

Green manuring with dhaincha on aman paddy.—1 acre.

The table below shows the results of *dhaincha* green-manured against unmanured :—

Name of variety.	GREEN MANURED OUTTURN PER ACRE IN LBS.		UNMANURED OUTTURN PER ACRE, IN LBS.	
	Grain.	Straw.	Grain.	Straw.
<i>Indrasail</i> paddy	...	2,463	4,586	1,340
<i>Nagra</i> paddy	...	2,421	4,506	1,188
				2,454
				2,182

It appears from the above table that green manuring with *dhaincha* on transplanted winter paddy has given a higher outturn than unmanured ones.

Jute.—The *olitorius* variety "Chinsura green" was grown for the first time on the farm and yielded 30 maunds 1 seer of fibre per acre. This shows that there is every chance of its suitability to this locality.

Cotton.—The Cambodia cotton was tried for the first time in this farm. The crop was attacked with Cotton Leaf Roller, but preventive measures were taken in time, thus checking the further spread of the pest. No definite conclusion can be drawn from this year's crop until it has been tried for some time more. 10 acre outturn, 14½ seers lint and seed.

Rahar.—*Comilla rahar* was grown for the second time in the farm. The crop on the whole was not good on account of the sandy nature of the soil where it was grown.

Peas, gram, mustard and linseed were also tried during the year in the farm and their respective yields are given below. It is expected that different kinds of *rabi* crops can be profitably cultivated in this locality, if means of irrigation can be provided :—

Name of crop.				Actual area under the crop.	Actual outturn.	Outturn per acre.
				Acres.	lbs.	lbs.
Peas	...	...	...	0.10	93½	937½
Gram	...	...	...	Nil	Nil	Nil
Mustard	...	...	...	0.10	27	270
Linseed	...	...	...	0.20	65½	327½

Potato manurial experiments.

Manures applied per acre.				Actual area in acres.	Actual outturn in lbs.	Outturn per acre in lbs.
1.	Cowdung	...	600 mds.	0.05	238	4,760
2.	Cowdung	...	200 "	0.05	280	5,600
	Castorcake	...	18 "			
3.	Cowdung	...	200 "	0.05	366	7,320
	Potato mixture No. I	...	18 "			
	(A substitute for castorcake of Messrs. Shaw, Wallace & Co., Calcutta).					
4.	Cowdung	...	200 "	0.05	374	7,480
	Potato mixture No. II.	...	18 "			
	(A special fertiliser for potato of Messrs. Shaw, Wallace & Co. Calcutta).					

Visitor.

The most notable visitor during the year was His Excellency the Governor and he evinced much interest in all that he saw.

The Collector of 24-Parganas visited the farm twice.

Sir Daniel Hamilton came out to India in December and stopped at Gosaba for some days during which he visited the farm several times and took much interest in the work which is being carried on.

Management.

The expense of the farm are borne by Sir Daniel Hamilton, but the management of the farm is partially in the hands of the Agricultural Department. I was the Superintendent of the farm throughout the year.

S. C. BANARJEE,

Superintendent, Gosaba Farm.

Manurial and varietal tests with paddy.

No.	Variety.	YIELD PER ACRE IN MDS. (1 MD. = 82 LBS).		REMARKS.
		Grain.	Straw.	
		Mds. Srs.	Mds. Srs.	
1	Patna with cowdung ...	25 20	35 25	132 maunds of cowdung applied per acre.
2	" without " ...	19 14	27 2	
3	" with bonemeal ...	21 0	29 8	3 maunds of bonemeal applied per acre.
4	" without " ...	20 34	28 38	
5	Indrasail with " ..	19 8	26 30	3 maunds of bonemeal applied per acre. The crop was slightly damaged by salt water from an adjacent khal.
6	" without " ...	18 18	25 26	Slightly damaged by salt water from an adjacent khal.
7	Nagra with " ...	17 16	24 10	3 maunds of bonemeal applied per acre.
8	" without " ...	9 18	12 36	This portion of land was found to be very saline, hence the poor result.
9	George " manure ...	20 34	28 38	Manurial experiment could not be carried out owing to insufficient rainfall. There was no accumulation of water in the plot selected, even in September.

Variety tests with sugarcane varieties.

No.	Varieties tried.	Results of the trial.
1	Yellow Tanna ...	Proved best growth, is luxuriant and it appears to suit this place.
2	Local acclimatised ...	Growth is not so prolific as No. 1. It is a thin cane.
3	Venda mukhi ...	Not successful.
4	B. 3412 ...	Ditto.
5	B. 147 ...	Ditto.
6	Shamsara ...	Ditto.
7	Dacca Ganderi ...	Ditto.
8	Red Mauritius ...	The crop is poor and stunted.

Without raising the land, the cultivation of sugarcane is not possible in the Sundarbans owing to the presence of salt in the soil. For this reason the sugarcane land has been raised to a foot with sweet earth from a paddy field. In unraised land both *Yellow Tanna* and *Red Mauritius* were tried, but neither survived.

Trials of other crops.—An attempt was made to grow jute, wheat, potato, gram, mustard and vegetables, but it was not successful owing to the presence of salt in the soil. The following crops were, however, found to grow under the same conditions:—Tomato, brinjal, khol rabi, mustard, radish and cabbage. Wheat requires sweet land to grow properly.

**Statement showing different items of expenditure at the Gosaba Farm
for 1920-21.**

No.	Crops cultivated and other expenditure.	Cost of cultivation.	Cost of manure applied.	Cost of seed used.	Total.	REMARKS.
		Rs. A. P.	Rs. A. P.	Rs. A. P.	Rs. A. P.	
1	Paddy ...	124 4 3	1 15 6	12 12 0	138 15 9	No price charged for the seed.
2	Sugarcane ...	65 7 9	36 12 0	50 4 0	152 7 9	
3	Jute ..	0 5 0	...	0 2 0	0 7 0	
4	Dhaincha ...	1 7 9	...	0 10 0	2 1 0	
5	Sunn hemp ...	3 8 3	...	...	3 8 3
6	Vegetable and rabi crops	35 1 3	13 12 6	12 2 0	60 15 9	
7	Miscellaneous expenditure	163 11 3	...	...	163 11 3
8	Land raising ...	205 5 3	...	...	205 5 0
	Total	727 8 9	

APPENDIX XI.

ANNUAL REPORT OF THE DACCA CENTRAL FARM, 1920-21.

The site of the farm was selected in December 1906 by Rai B. C. Basu, Bahadur, and was approved after inspection by Sir Bampfylde Fuller, then Lieutenant-Governor of Eastern Bengal and Assam, and Mr. (now Sir) Frank Sly, then Inspector-General of Agriculture.

Besides serving as an experimental station, the farm is the headquarters of the Expert staff of the Département.

Description of the farm.

The farm comprises a compact block of land, 353·7 acres (1,070 bighas) in area, situated between the Mymensingh and the Mirpur Roads, 5 miles to the north of Dacca Railway station, near the village of Manipur. The land was acquired at a cost of Rs. 70,043, and at the time of acquisition was chiefly occupied by thatching grass, scrub jungle and mango topes, only a small portion being under cultivation. A large area of jungle has since been reclaimed and the land levelled and laid out into regular fields. At present 215 acres are cultivated, the remainder being under roads, buildings and pasture.

Soil.

The soil of the farm is a stiff red laterite typical of a considerable tract, including the Madhupur jungle and the "barind" of the Rajshahi Division. In the dry season the red clay sets hard like cement and the soil loses moisture rapidly. It is deficient in organic matter. The soil in the low lands is more productive than that of the high land owing to continuous deposits.

The low land is suitable for transplanted winter paddy, whilst jute, *aus* paddy, sugarcane, etc., are grown on the high land.

Buildings.

At present there are 23 quarters on the farm, but there are 20 members of the staff still unaccommodated. This has caused considerable inconvenience both as regards work and to the family life of these officers. New quarters have been administratively sanctioned, but no funds have so far been forthcoming.

Laying out.

The work of levelling and laying out has been continued, two more fields having been completed. A road connecting the Mymensingh Road with Mastul Road has been finished and on the completion of the new railway station will be the direct route from the farm.

Season.

The rainfall was well distributed, but a shortage in October and November affected the sugarcane crop. A table showing the rainfall month by month is appended.

Operations during the year.

Rice Crop.

Aus paddy.—As in the previous year, *Kataktara aus* paddy was grown for multiplication. *Surjamukhi*, a variety which resembles *Kataktara* closely, was again tested and showed great promise. *Charnock*, a very fine grained variety, was also grown.

Great difficulty was felt at the time of harvest owing to persistent rain, and this difficulty will always arise until a threshing machine can be provided.

Aman paddy.—*Indrasail* paddy was again grown as the main crop. Varietal tests were conducted with *Indrasail* against three other high yielders raised by the Economic Botanist. Results are tabulated in Appendix III, where it will be seen that both *Tilakkachari* and *Dudshar* gave higher outturns than *Indrasail*.

The experiments are not conclusive, and will be continued. It has been noticed, however, that on intermediate lands *Dudshar* has shown great promise.

Manurial experiments have been continued, and results will be found in appendices.

Sugarcane.—Forty-seven varieties in all were tested and rigid examination for disease was made. A table showing the number of canes per acre affected with red rot is appended. It will be seen that *Yellow Tanna* has sustained its reputation, and that *Hemza* has also proved a good resister. The bulk of the area this year has been allotted for multiplication of *Yellow Tanna*, but some of the other varieties will still be kept under observation. Owing to difficulty in obtaining *Yellow Tanna* from outside sources the bulk of the crop was made into cuttings.

Jute.—The Fibre Expert deals with this crop in his report.

Fodder-crops.—Twelve acres were put under fodder crops—maize, juar and cowpea—and the crops ensilaged for the cattle. Varietal experiments were carried out with different varieties of maize and species of millets. The results were incomplete, but Kalimpong maize and bajra gave bulky crops, as also did transplanted murua.

Tobacco.—Bhengi (*N. tabacum*) and Motihari (*N. rustica*) were tested in adjoining plots. The Motihari seed was very mixed, and this spoilt the value of the experiment. The Motihari, however, did not show such good growth as the *Bhengi*, which appeared better suited to the red soil.

Rabi Crops.

Small areas were put down under pulses and wheat. Sowings were somewhat late. It was, however, conclusively proved that without irrigation *rabi* crops are a failure on the red soil.

Miscellaneous.

Cattle.—Thirteen casualties occurred during the year, an unfortunate attack of foot and mouth disease taxing the older animals to the limit. The majority of the bullocks are getting past work, and it is necessary to purchase a new lot.

Practical Training in Agriculture.

Twenty-five boys received instruction on the farm during the year, and at the examination held for demonstrators all but three obtained pass marks. Besides practical work, the boys were given short lectures in agriculture, cattle management, pests, book-keeping, etc.

Implements.

Towards the end of the year a Glasgow Tractor was received from Scotland, but data as to working are not yet available.

A disc plough and disc harrow were kindly lent by the Agricultural Adviser, and later on an Oliver plough, a disc harrow and a seed drill were placed at our disposal by Ford Motors, Ltd.

A small combined Oskosh pumping set received from Messrs. Ivan Jones & Co. proved most efficient and inexpensive to run. Its initial cost is about Rs. 2,000 and as it is of simple construction, it is well suited for irrigation purposes. It pumps 4,000 gallons an hour without difficulty.

The use of the mhote for irrigation was demonstrated on the farm and created great interest.

Conference.

The annual Panchayati Conference was held on the farm in July. Demonstrations were given in the morning and in the afternoon the Conference was held and His Excellency the Governor addressed the meeting.

In February a successful meeting of representatives of village agricultural Associations was held on the farm and demonstrations were arranged for the members.

Dairy.

A small dairy has been started in connection with the agricultural school with a small herd of Scindi cattle as a nucleus.

Visits.

His Excellency the Governor visited the farm.

The Hon'ble Maharajadhiraja of Burdwan, Sir Charles Stevenson-Moore, the Commissioner of the Dacca Division, the Collectors of all the districts in the Dacca Division and many others visited the farm.

Establishment.

Babu Santi Prosad Sen Gupta held charge as Superintendent until August when he proceeded to Scotland for further study. Munshi Abdul Jalil held charge in his place and Babu Amrita Lal Mukherjee was appointed temporarily as Assistant Farm Superintendent.

Receipts and Expenditure.

Rupees 4,927-3-3 were credited to the treasury. *Kataktara* and *Indrasail* paddy was handed over to the Seed Store.

The expenditure incurred amounted to Rs. 55,948-1-8 which included capital expenditure, repairs, laying out, etc.

APPENDIX XI.

ANNUAL REPORT OF THE DACCA CENTRAL FARM, 1920-21.

The site of the farm was selected in December 1906 by Rai B. C. Basu, Bahadur, and was approved after inspection by Sir Bampfylde Fuller, then Lieutenant-Governor of Eastern Bengal and Assam, and Mr. (now Sir) Frank Sly, then Inspector-General of Agriculture.

Besides serving as an experimental station, the farm is the headquarters of the Expert staff of the Département.

Description of the farm.

The farm comprises a compact block of land, 353·7 acres (1,070 bighas) in area, situated between the Mymensingh and the Mirpur Roads, 5 miles to the north of Dacca Railway station, near the village of Manipur. The land was acquired at a cost of Rs. 70,043, and at the time of acquisition was chiefly occupied by thatching grass, scrub jungle and mango topes, only a small portion being under cultivation. A large area of jungle has since been reclaimed and the land levelled and laid out into regular fields. At present 215 acres are cultivated, the remainder being under roads, buildings and pasture.

Soil.

The soil of the farm is a stiff red laterite typical of a considerable tract, including the Madhupur jungle and the "barind" of the Rajshahi Division. In the dry season the red clay sets hard like cement and the soil loses moisture rapidly. It is deficient in organic matter. The soil in the low lands is more productive than that of the high land owing to continuous deposits.

The low land is suitable for transplanted winter paddy, whilst jute, *aus* paddy, sugarcane, etc., are grown on the high land.

Buildings.

At present there are 23 quarters on the farm, but there are 20 members of the staff still unaccommodated. This has caused considerable inconvenience both as regards work and to the family life of these officers. New quarters have been administratively sanctioned, but no funds have so far been forthcoming.

Laying out.

The work of levelling and laying out has been continued, two more fields having been completed. A road connecting the Mymensingh Road with Mastul Road has been finished and on the completion of the new railway station will be the direct route from the farm.

Season.

The rainfall was well distributed, but a shortage in October and November affected the sugarcane crop. A table showing the rainfall month by month is appended.

Operations during the year.

Rice Crop.

Aus paddy.—As in the previous year, *Kataktara aus* paddy was grown for multiplication. *Surjamukhi*, a variety which resembles *Kataktara* closely, was again tested and showed great promise. *Charnock*, a very fine grained variety, was also grown.

Great difficulty was felt at the time of harvest owing to persistent rain, and this difficulty will always arise until a threshing machine can be provided.

Aman paddy.—*Indrasail* paddy was again grown as the main crop. Varietal tests were conducted with *Indrasail* against three other high yielders raised by the Economic Botanist. Results are tabulated in Appendix III, where it will be seen that both *Tilakkachari* and *Dudshar* gave higher outturns than *Indrasail*.

The experiments are not conclusive, and will be continued. It has been noticed, however, that on intermediate lands *Dudshar* has shown great promise.

Manurial experiments have been continued, and results will be found in appendices.

Sugarcane.—Forty-seven varieties in all were tested and rigid examination for disease was made. A table showing the number of canes per acre affected with red rot is appended. It will be seen that *Yellow Tanna* has sustained its reputation, and that *Hemza* has also proved a good resister. The bulk of the area this year has been allotted for multiplication of *Yellow Tanna*, but some of the other varieties will still be kept under observation. Owing to difficulty in obtaining *Yellow Tanna* from outside sources the bulk of the crop was made into cuttings.

East Suti, 1920-21.

RESIDUAL EFFECT, PLOTS $\frac{1}{12}$ ACRE EACH.

Crop—Kataktara Paddy (Aus).

BRICKFIELD RAVINE.

KHOSKHANA
RAVINE.

ROAD TO SOUTH
MIRPUR GATE.

676	n	886	p
1,205	m	763	o
935	l	640	f
910	k	1,246	e
713	j	1,279	d
1,066	i	1,525	c
1,353	h	1,685	b
1,476	g	1,230	a
283	10	828	20
947	9	1,353	19
3,444	8	1,390	18
492	7	1,599	17
418	6	1,574	16
1,107	5	676	15
1,303	4	787	14
1,279	3	1,266	13
1,254	2	1,279	12
1,230	1	566	11

ROAD TO MASTUL.

Manurial Scheme.

Plots 4, 9, 12, 17, b, d, f, g, h, m, p—

Bonemeal, 480 lbs. per acre.

Am₂, S O₄ at 54 lbs. per acre.

Plots 3, 7, 13, 18, a, c, j, k, n, o—

Rock phosphate at 310 lbs. per acre.

Sulphate of ammonia at 154 lbs.
per acre.Plots 1, 2, 5, 6, 8, 10, 11, 14, 15, 16, 19, 20,
e, i, l—Sulphate of ammonia at 154 lbs.
per acre.

Outturn per acre given in lbs.

East Ravine, Residual Effect.

YIELD PER ACRE OF PLOTS, $\frac{1}{10}$ ACRE EACH.

Crop—Indrasali Paddy.

52	46	43	39	37	31
2,675	2,060	2,470	2,215	2,080	2,121
51	47	42	40	36	33
1,701	2,193	2,296	2,183	2,152	2,060

Plots Nos.	31 and 36	...	I. O. P. cake	300 lbs. per acre.
" "	33 and 37	...	Mustard cake	370
" "	39 and 40	...	Shrimp waste	300
" "	43, 47 and 52	...	Steamed bonemeal	240
" "	46 and 51	...	Unsteamed bonemeal	250
			Outturn per acre in lbs.	

The residual effect of the bonemeal is still apparent.

APPENDIX XII.

ANNUAL REPORT OF THE TIPPERA DISTRICT FARM, COMILLA, FOR 1920-21.

The farm is situated one mile west of Comilla Town, near the railway station. The Grand Trunk Road from Dacca to Comilla forms the boundary on the northern side.

Actual cultivation on the farm only commenced in April 1920.

Except for a small area in the north-east corner, there is no high land in the farm which is thus unsuitable for other than paddy cultivation.

The farm has been laid out into $\frac{1}{10}$ acre plots and the levelling of fields and raising of roads has reduced the fertility of the soil, which will have to be restored by heavy manuring. It will therefore be difficult to arrange for reliable variety test for a year or so.

The farm suffers from lack of facilities for drainage, and it is proposed to excavate a drain to meet a khal a short distance down the Daudkandi Road. When this is done, there should be considerable improvement, especially in the south-eastern block, where water lodges badly at present.

Crops.

Kataklara paddy.—The seed was sown late, and heavy rain in May flooded the land. The crop was fed off to the cattle.

Indrasail paddy.—Thirty-seven bighas were transplanted with *Indrasail* paddy. The crop was fair, giving an average yield of 15 maunds per acre. Owing to unevenness of the land due to levelling, many of the plots gave poor outturns, and they have been marked off for special treatment, with a view to restoring their fertility.

Rabi crops.—Khesari, gram, peas, masuri, wheat, tobacco and English vegetables were grown in the *rabi* season. Heavy rain in March affected the yield badly.

Pusa No. 12 wheat was tested against the local Gangajali and proved superior.

Inspection.

The farm was inspected by the Director of Agriculture and the Deputy Director of Agriculture and the Superintendent of Agriculture.

Establishment.

Babu Nalini Kanta Sen was in charge at the beginning of the year, when it was found necessary to transfer him to Narayanganj, and depute Babu Benode Lal Mukherjee, an experienced officer, to take over charge. On the transfer of Babu Benode Lal Mukherjee to Chittagong Babu Benode Chandra Ghose was posted to Comilla.

Receipts and Expenditure.

A sum of Rs. 10-9-3 was credited to the treasury. Articles worth about Rs. 555 are in stock.

The expenditure incurred amounted to Rs. 4,415-7-3, which included capital expenditure, laying out, etc.

APPENDIX XIV.

REPORT OF THE CATTLE FARM, RANGPUR, FOR THE YEAR 1920-21.

Site and description.

The farm is situated close to the railway station, and the railway line crosses the farm on the eastern side, a block of land of 54.75 acres lying on the other side of the line. There being no level-crossing, the cultivation of this portion is costly, as the only road which leads to that block is a roundabout one.

Soil.

The soil of this farm is mostly a sandy loam and appears to be deficient in lime. There are patches in some plots which are quite barren. The Agricultural Chemist has already taken up the matter very recently, and the result of his chemical examination and remedies are eagerly awaited.

Reclamation.

A good deal of reclamation was done during the year. A plot of 48 acres, which was full of jungle, was reclaimed. Another plot measuring about 10 acres of this was utilized for growing Musuri (*Ervum lens*). An old tank on this farm has been re-excavated, as there were no proper watering and bathing facilities for the cattle.

Petty construction and repairs.

In the year under report two segregation sheds were built, and drains have been partly constructed in the cattle sheds. To avoid leakage and wastage of cattle urine, two urine pits have recently been constructed; a considerable loss of manurial matter is thereby checked. There are no walls to the cattle sheds, which are thus exposed to the extremes of climates. As a temporary measure, moveable mat walls have been put up.

Condition of the herd.

The Hissar bull (Carfox) died on 6th September 1920 from an attack of rheumatism and high fever in spite of every possible treatment and care. Two new Hissar bulls have recently been purchased for breeding purpose. Thirty cross-bred females and 24 cross-bred males have been bred, out of which 6 cross-bred males will be ready for service and 12 females will be ready for breeding after six months. In the indigenous herd 10 farm-bred heifers have been transferred to the cow herd and seem to be promising, each giving about 10 lbs. of milk daily during their first lactation period. The cross-bred stock, however, shows a decided improvement over the *desi* stock of similar age.

Conference for the elimination of cattle.

The stock of cattle in this farm having considerably increased, and accommodation being quite insufficient, a conference of the expert officers was held on the 20th April 1920, to eliminate the undesirable cattle.

Elimination was decided upon after a consideration of the following points:—

- (a) Old age.
- (b) Milk yield of 500 lbs. and under per annum.
- (c) Cows that have not calved for more than three years.
- (d) Cows which have lost teats.
- (e) Cows whose colour does not approximate to the standard grey, laid by Mr. Milligan.

The progeny of rejected cows were also eliminated. Forty-one cows, 34 female and 9 male calves were rejected and disposed of by public auction.

Strength of herd.

Number of animals on the 31st March 1921—

Cows	...	...	...	56	{	Hissar	33
						Country	23
Calves below one year	...	...	...	30	{	Male	10
						Female	20
Young stock, one year and above	...	...	...	82	{	Male	46
						Female	36
Bulls	...	...	...	6			
Bullocks	...	...	...	52			
Castrated	...	...	...	21			
Total	...	...	...	247			

The following table will show the average milk yield during the year 1920-21 :—

Months.	Average yield in lbs.
April 1920	2.56
May "	2.34
June "	2.38
July "	2.74
August "	2.94
September "	2.74
October "	2.94
November "	2.6
December "	2.8
January 1921	4.8
February "	4.4
March "	5.3

Comparing with the last year's result, the average yield seems to be increasing; this is due to the introduction of farm-bred heifers in the herd.

General health of the animals.

The general health of the animals seems to be improving gradually since January last.

Disease and Casualties of animal.

There was an outbreak of rinderpest in the month of April. Immediate detection and prompt medical measures were successful in controlling the disease, and only one cow, which was first attacked, was lost.

Hæmorrhagic Septicæmia appeared in the herd in the month of July, but it was checked by prompt inoculation, segregation, etc. A serious attack of 'Foot-and-mouth disease' broke out in the herd in the month of August 1920. This told much on the health of the cattle. Proper care and treatment was taken, and there was only a single death out of 240 attacks.

List of Casualties.

Serial No.	Class of animal.	Cause of death.	Remarks.
1	1 cow	Rinderpest.	Rejected by the conference.
2	1 "	Old age and debility	
3	1 bull (Carfox)	High fever and rheumatism.	
4	4 bull calves	Rachitis and debility.	
	1 bull calf	Impaction of the third stomach.	
5	4 heifers	Pneumonia and Rachitis.	
6	9 sucklings	Rachitis and dysentery.	
	2 "	Still-born (twin).	

Climatic Condition.

The following table will show the rainfall statistics of the locality :—

Monthly rainfall register of station, Rangpur District.

April 1920	3.01
May "	5.82
June "	15.37
July "	8.62
August "	18.82
September "	29.28
October "	17.49
November "	Nil
December "	Nil
January 1921	1.19
February "	Nil
March "	3.75

The climatic conditions of the place are not at all satisfactory. Last year in the beginning of *kharif* season, there was insufficient rain, which caused late sowing of crops. Subsequently heavy showers during the first half of September and second half of November inundated practically the whole land of this farm, twice destroying the entire transplanted paddy and jowar crop grown in medium high lands.

Fodder Crops.

Maize, jowar and cowpea in the *kharif* and oats and peas in the *rabi* season were grown for fodder purpose. The *kharif* fodder crops in higher lands gave satisfactory results; the outturn of jowar was very poor owing to an attack of a bacterial disease.

The following outturn of fodder, as in this farm, is tabulated below:—

Plot No.			Area.	Total outturn.	Outturn per acre.
			Bighas.	Mds.	Mds.
6	...	...	18.05	1,500	250
9	...	...	23.00	1,920	400
8	...	...	9.00	420	200
46	...	...	5.00	200	150
49	...	...	4.34	400	300
50A	...	...	4.50	300	200
58	...	...	28.80	3,000	200
<i>Jowar.</i>					
5	...	...	18.00	1,000	50
37	...	...	10.60	900	80
38	...	...	12.63	1,000	50
48	...	...	13.34	1,296	90
51	...	...	6.25	400	100
<i>Cowpea.</i>					
40	...	...	8.12	72	36
43	...	...	7.45	60	30
50B	...	...	10.14	200	30

OATS AND PEAS.*Green fodder.*

[200.5 (expected), 6,000 maunds and 30 maunds].

Two varietal experiments with fodder crops were conducted—

- (1) Local maize *versus* Kalimpong (varieties).
- (2) Local jowar *versus* Sundhia and Utavali.

Results of crop-cutting experiments conducted on local maize *versus* yellow round, yellow flat, white flat, white round, red round and Sutton giant, 1920-21.

Plot No.	Area.	Name of variety.	Date of sowing.	Date of harvesting.	Actual weight.	Outturn per acre.
	Acre.		1920.	1920.	Mds. s.	Mds. s.
1	1 st 5 th	Local maize ...	5th June ...	29th August ...	11 20	230 0
2	Do.	Yellow round ...	5th " ...	30th " ...	14 30	295 0
3	Do.	Local ...	5th " ...	30th " ...	11 0	220 0
4	Do.	Yellow round ...	5th " ...	31st " ...	14 0	280 0
5	Do.	Local ...	5th " ...	31st " ...	12 0	240 0
6	Do.	White flat ...	5th " ...	1st September ...	12 0	240 0
7	Do.	Local ...	5th " ...	2nd " ...	12 20	250 0
8	Do.	Yellow flat ...	5th " ...	3rd " ...	13 30	275 0
9	Do.	Local ...	5th " ...	3rd " ...	12 36	258 0
10	Do.	Yellow round ...	5th " ...	4th " ...	14 0	280 0
11	Do.	Local ...	5th " ...	4th " ...	12 35	257 20
12	Do.	Sutton giant ...	5th " ...	5th " ...	14 0	280 0
13	Do.	Local ...	5th " ...	5th " ...	13 5	262 0
14	Do.	Red-round ...	5th " ...	5th " ...	13 0	260 0
15	Do.	Local ...	5th " ...	6th " ...	14 0	280 0
16	Do.	White round ...	5th " ...	6th " ...	14 0	280 0
17	Do.	Local ...	5th " ...	6th " ...	13 22	271 0
18	Do.	Yellow round ...	5th " ...	7th " ...	14 0	280 0
19	Do.	Local ...	5th " ...	7th " ...	13 25	272 20
20	Do.	Yellow round ...	5th " ...	7th " ...	14 12	286 0

From the above table it will be seen that the Kalimpong maize on an average beat the local variety by 20.5 maunds per acre. Again Kalimpong yellow round topped the list.

Results of crop-cutting experiments conducted on local Jowar *versus* Sundhia and Utavali Jowars during the year 1920-21.

Plot No.	Area.	Name of variety.	Date of sowing.	Date of harvesting.	Actual weight.	Outturn per acre.
	Acre.		1920.	1920.	Mds. srs.	Mds. srs.
1	$\frac{1}{10}$ th	Local Jowar	19th June ...	13th October ...	21 0	420 0
2	Do.	Sundhia ...	19th " ...	13th " ...	17 0	340 0
3	Do.	Local ...	19th " ...	13th " ...	20 0	400 0
4	Do.	Sundhia ...	19th " ...	14th " ...	18 0	360 0
5	Do.	Local ...	19th " ...	14th " ...	20 0	400 0
6	Do.	Utavali ...	19th " ...	14th " ...	No germination.	
7	Do.	Local ...	19th " ...	14th " ...	19 0	380 0
8	Do.	Utavali ...	19th " ...	15th " ...	20 0	400 0
9	Do.	Local ...	19th " ...	15th " ...	23 0	460 0
10	Do.	Utavali ...	19th " ...	15th " ...	18 0	360 0
11	Do.	Local ...	19th " ...	15th " ...	21 0	420 0
12	Do.	Utavali ...	19th " ...	16th " ...	9 0	380 0
13	Do.	Local ...	19th " ...	16th " ...	20 0	400 0
14	Do.	Utavali ...	19th " ...	16th " ...	No germination.	
15	Do.	Local ...	19th " ...	16th " ...	22 0	440 0
16	Do.	Sundhia ...	19th " ...	16th " ...	15 0	300 0
17	Do.	Local ...	19th " ...	17th " ...	25 0	500 0
18	Do.	Sundhia ...	19th " ...	17th " ...	19 0	380 0
19	Do.	Local ...	19th " ...	17th " ...	23 20	470 0
20	Do.	Sundhia ...	19th " ...	17th " ...	18 0	360 0

The above table will show that the local Jowar gave better results during the year under report.

There was about one acre of land under jute (Fibre Expert's D. 154) for seed production. In another acre of land the varietal experiment of jute was conducted, the result of which is tabulated below :—

Plot No.	Name of variety.	Date of sowing.	Date of harvesting.	Date of steeping.	Date of stripping.	Green weight of jute plant.	Actual outturn of fibre.	Outturn per acre.	No. of bundles.
		1920.	1920.	1920.	1920.	Mds. srs.	Mds. srs. chs.	Mds. srs.	
1	D. 154 ...	16th March ...	18th September	18th September	18th October...	21 14	1 15 0	27 20	31
2	K. B. ...	16th " ...	16th " "	16th " "	18th " ...	19 18	1 7 0	23 20	25
3	D. 154 ...	16th " ...	16th " "	16th " "	18th " ...	22 20	1 15 0	27 20	29
4	K. B. ...	16th " ...	16th " "	16th " "	18th " ...	21 34	1 11 0	25 0	30
5	D. 154 ...	16th " ...	16th " "	16th " "	20th " ...	23 4	1 15 0	27 20	32
6	R. 85 ...	16th " ...	16th " "	16th " "	20th " ...	21 38	1 15 0	27 20	27
7	D. 154 ...	16th " ...	16th " "	16th " "	20th " ...	18 5	1 9 0	24 20	27
8	R. 85 ...	16th " ...	14th " "	16th " "	20th " ...	18 30	1 12 12	25 15	26
9	D. 154 ...	16th " ...	14th " "	16th " "	20th " ...	25 0	1 17 0	28 20	30
10	K. B. ...	16th " ...	14th " "	16th " "	20th " ...	22 30	1 12 0	26 0	29
11	D. 154 ...	16th " ...	14th " "	16th " "	24th " ...	24 21	1 16 0	28 0	28
12	R. 85 ...	16th " ...	14th " "	16th " "	24th " ...	24 2	1 20 0	30 0	26
13	D. 154 ...	16th " ...	10th " "	18th " "	17th " ...	24 15	1 27 8	33 30	26
14	K. B. ...	16th " ...	10th " "	18th " "	17th " ...	22 20	1 20 0	30 0	25
15	D. 154 ...	16th " ...	10th " "	18th " "	17th " ...	23 20	1 4 0	22 0	24
16	R. 85 ...	16th " ...	10th " "	18th " "	17th " ...	19 30	1 12 0	26 0	22
17	D. 154 ...	16th " ...	8th " "	18th " "	16th " ...	21 25	1 8 0	24 0	22
18	K. B. ...	16th " ...	8th " "	18th " "	16th " ...	14 20	0 28 0	14 0	21
19	D. 154 ...	16th " ...	8th " "	18th " "	16th " ...	18 25	1 7 6	25 0	25
20	R. 85 ...	16th " ...	8th " "	18th " "	16th " ...	20 35	1 23 8	31 30	22
21	D. 154 ...	16th " ...	7th " "	18th " "	16th " ...	18 25	1 4 4	22 5	23
22	R. 85 ...	16th " ...	7th " "	18th " "	14th " ...	16 0	1 8 12	23 15	23
23	D. 154 ...	16th " ...	7th " "	18th " "	14th " ...	13 20	1 2 0	21 0	22
24	K. B. ...	16th " ...	7th " "	18th " "	14th " ...	13 35	1 5 0	22 20	29

The crop-cutting experiments conducted on *Kataktara* (E. B.'s selected variety), Sonamail and Chapalo gave the following results:—

Plot No.	Sub-plot No.	Area in acres.	Variety.	Date of sowing.	Date of flowering.	Date of ripening.	Date of harvesting.	Green weight of paddy.	Actual weight of paddy.	Weight of straw.	Outturn per acre.
				1920.	1920.	1920.	1920.	Mds. srs. chs.	Mds. srs. chs.	Mds. srs.	Mds. srs.
25	1	28th	Chapalo ...	1st May	1st July	24th July ...	28th July ...	0 35 8	0 20 0	5 20	10 0
25	2	Do.	Kataktara ...	1st "	11th "	11th August	14th August	1 0 0	0 32 0	5 35	16 0
25	3	Do.	Chapalo ...	1st "	1st "	24th July ...	26th July ...	0 39 8	0 26 0	3 35	13 0
25	4	Do.	Kataktara ...	1st "	11th "	11th August	14th August	1 6 8	0 39 8	5 10	19 10
25	5	Do.	Chapalo ...	1st "	1st "	24th July ...	26th July ...	0 33 0	0 24 0	4 35	12 0
25	6	Do.	Kataktara ...	1st "	11th "	11th August	14th August	1 5 0	1 0 0	7 0	20 0
25	7	Do.	Chapalo ...	1st "	1st "	24th July ...	26th July ...	1 1 0	0 27 0	4 35	13 20
25	8	Do.	Kataktara ...	1st "	11th "	11th August	14th August	1 9 8	1 0 0	5 30	20 0
25	9	Do.	Chapalo ...	1st "	1st "	24th July ...	26th July ...	0 35 0	0 24 0	5 10	12 0
25	10	Do.	Kataktara ...	1st "	11th "	11th August	14th August	1 20 0	1 14 8	5 30	27 10
25	11	Do.	Sonamail ...	1st "	16th "	21st "	21st "	1 2 0	0 36 0	3 37	18 0
25	12	Do.	Kataktara ...	1st "	11th "	11th "	14th "	1 20 0	1 10 9	5 5	25 0
25	13	Do.	Sonamail ...	1st "	16th "	21st "	21st "	0 36 0	0 28 0	5 0	14 0
25	14	Do.	Kataktara ...	1st "	11th "	11th "	14th "	1 10 0	1 0 0	5 5	20 0
25	15	Do.	Sonamail ...	1st "	11th "	21st "	21st "	0 35 0	0 27 0	4 23	13 20
25	16	Do.	Kataktara ...	1st "	11th "	11th "	14th "	1 10 0	1 1 0	5 30	20 20
25	17	Do.	Sonamail ...	1st "	16th "	21st "	21st "	1 0 0	0 33 8	4 20	16 30
25	18	Do.	Kataktara ...	1st "	11th "	11th "	14th "	1 0 0	0 30 0	6 0	15 0
25	19	Do.	Sonamail ...	1st "	16th "	21st "	21st "	0 27 0	0 21 0	5 25	10 20
25	20	Do.	Kataktara ...	1st "	11th "	11th "	14th "	1 0 0	0 32 8	5 35	16 10

Transplanted paddy.

As all the plots of transplanted paddy were under flood, the crop was a failure one. Though the area under transplanted paddy was washed away by flood, the total outturn got from scattered bunches of crop here and there was 67 maunds 27 seers of *Indrasail* paddy.

Visits and inspection.

In the year under report His Excellency Lord Ronaldshay, K.C.B., G.C.I.E. etc., Governor of Bengal, kindly visited the farm accompanied by the Private Secretary, Military Secretary, the Commissioner of the Rajshahi Division, and the Collector of Rangpur.

The farm was also visited once by the Imperial Agriculturist and several times by the Director of Agriculture, Bengal.

Staff.

The staff consists of one Superintendent, two Assistant Superintendents, four Overseers and one clerk.

Financial statement of the Cattle Farm, Rangpur, for the year 1920-21.

RECEIPTS.				EXPENDITURE.			
	Rs.	A.	P.		Rs.	A.	P.
Amount credited into the treasury	5,764	8	9	Establishment ...	4,310	2	4
Stock in hand on 1st April 1921	886	13	6	Recurring expenditure—Purchase and feed of cattle.	17,447	6	3
Bill outstanding for farm produce of 1920-21.	245	15	9	Purchase of seeds, manure and implements.	2,201	10	9
Bill outstanding for previous year's farm produce.	553	1	6	Wages of labour ...	15,489	6	9
	7,450	7	6	Laying out and maintenance ...	4,786	7	0
Deduct—Bills outstanding for previous year's farm produce.	553	1	6	Petty construction and repairs ...	5,321	7	9
	6,897	6	0	Service postage stamps and telegram charges.	130	0	0
Deduct—Value of previous year's farm produce realised during this year.	1,000	5	3	Purchase of furniture ...	90	0	0
				Office expenses and miscellaneous	3,198	5	9
				Cost of medical aid	243	12	0
Grand Total	5,897	0	9	Total	48,908	8	3
				Grand Total	53,218	10	7

J. N. SARKAR,

Offg. Deputy Director of Agriculture, Northern Circle.

APPENDIX XV.

ANNUAL REPORT OF THE RANGPUR DEMONSTRATION FARM FOR THE YEAR 1920-21.

Introductory.

The farm is situated in the town of Rangpur. It was started by the Rangpur District Agricultural Association with the object of carrying out experiments on agriculture, and it was made over to the Department of Agriculture, Bengal, in 1911; since then it has been used for comparative trials with seeds raised by the Experts against the best local varieties, and also for the multiplication of improved seeds for distribution amongst the cultivators in the district.

Area.

The farm has an area of 19.16 acres of land out of which 16 acres are under cultivation, the rest being occupied by roads, drains, pathways, buildings, etc.

Soil.

The soil of the farm is a rich moist loam of light texture with a sub-soil of pure sand at a depth of about 7 feet.

Rainfall and character of the season.

The rainfall during the year under review was as follows :—

Month.	ACTUAL RAINFALL.		NORMAL RAINFALL.	
	Amount of rainfall.	Number of rainy days.	Amount of rainfall.	Number of days.
April 1920 ...	3.01	4	3.01	4.3
May " ...	5.82	9	10.66	11.5
June " ...	15.37	20	18.00	15.7
July " ...	8.62	17	15.89	15.0
August " ...	18.82	21	12.80	15.7
September " ...	29.28	16	14.24	13.3
October, " ...	17.49	15	4.87	4.4
November " ...	Nil	Nil	0.12	0.2
December " ...	Nil	Nil	0.05	0.2
January 1921 ...	1.19	3	0.50	0.9
February " ...	Nil	Nil	0.50	1.2
March " ...	3.75	3	1.25	1.8
Total ...	103.35	98	81.93	82.2

The season was on the whole fair for *Bhadoi* crops, but it was poor for transplanted winter paddy which suffered much from want of sufficient water during transplanting time. Constant showers in September flooded a portion of the standing crop. Rains in February and March accompanied with hailstorms caused considerable damage to the wheat and flax.

I.—Trials of new varieties.

- (a) *Varistal test*.—*Aus* paddy—*Kataktara* paddy *versus* Chapalo and Sonamail (local).
 (b) *Ditto* Winter paddy—*Indrasail* *versus* local Jasoa.
 (c) *Ditto* Jute—D. 154 *versus* R. 85 and K. B.
 (d) *Ditto* Potato—Darjeeling *versus* Shillong and country.
 (e) *Ditto* Wheat—Gangajali *versus* Pusa 12.
 (f) *Ditto* Sugarcane.

II.—Experiments.

- A.—Irrigation experiment with wheat, barley and oats.
 B.—Manurial experiment on potato—special fertiliser (from Messrs. Shaw, Wallace & Co.) No. I and II *versus* cowdung and castorcake.
 C.—Pure line cultures of *kalai* and mustard.
 D.—Spacing experiments on potato.
 E.—Cultivation of flax.

In addition to the above the following crops were also grown :—

- (a) Winter paddy for seed.
- (b) Jowar for fodder.
- (c) Oats and peas for fodder.
- (d) Khesari for fodder.

Trials of varieties.

(a) *Aus paddy (Oryza sativa)*.—With the object of showing the superiority of *Kataktara* it was tried against two local varieties, Sonamail and Chapalo, on the same system as last year. The table given below shows that *Kataktara* gave an increased outturn of 5 maunds 30 seers over Sonamail and 6 maunds 15 seers over Chapalo per acre :—

Variety.	No. of plot.	Area in acre.	Actual outturn.	Average outturn.	Outturn per acre.
			Mds. sr. ch.	Mds. sr. ch.	Mds. sr. ch.
Kataktara	16	80	17 16 8	1 3 8	21 30 0
Sonamail	8	40	6 15 8	0 31 14	16 0 0
Chapalo	8	40	6 6 0	0 30 12	15 15 0

(b) *Winter paddy*.—*Indrasail* was grown against local variety Jasoa. For want of sufficient rainfall in July transplantation of seedlings were much damaged by the rains in September. Consequently, the experiment altogether failed.

(c) *Jute (C. Capsulari)*.—In low land *Kakya Bombai* jute was tried against a local early variety. The result will show that though the crop was harvested at an early stage to avoid water-logging, *Kakya Bombai* gave an increased outturn of 1 maund 4 seers per acre.

No. of plots.	Variety.	Area in acre.	Actual outturn.	Outturn per acre.
			Mds. sr. ch.	Mds. sr. ch.
1	Kakya Bombai	$\frac{1}{10}$	0 37 12	9 17 8
2	Local	"	0 31 8	7 35 0
3	Kakya Bombai	"	1 9 8	12 15 0
4	Local	"	1 7 0	11 30 0

Varietal tests of jute.—D. 154 was tried against R. 85 and *Kakya Bombai*. The following table will show that D. 154 gave a better outturn than others :—

Number of sub-plots.	Variety.	Area in acres.	Actual outturn.	Outturn per acre.	Average outturn per acre.	REMARKS.
			Mds. sr. ch.	Mds. sr. ch.	Mds. sr. ch.	
1	D. 154	$\frac{1}{10}$	2 12 0	23 0 0	19 16 8	D. 154.
2	R. 85	"	2 18 0	20 15 0	...	...
3	D. 154	"	1 31 12	17 37 8	...	...
4	R. 85	"	0 30 8	7 25 0	14 0 0	R. 85.
5	D. 154	"	1 13 12	13 17 8	...	...
6	K. B	"	1 6 8	11 25 0	...	...
7	D. 154	"	1 22 0	15 20 0	...	...
8	K. B	"	2 26 0	26 20 0	19 2 8	Kakya Bombai.
9	D. 154	"	2 28 12	27 7 8	...	...

(D) *Potato (Solanum tuberosum)*.—Three varieties of potatoes were tried this year. The results are tabulated below:—

Varietal test 2 feet apart.

Variety.			Area in acres.	Actual outturn.	Outturn per acre.	REMARKS.
				MDS. SR. CH.	MDS. SR. CH.	
Country	...	...	$\frac{1}{10}$	14 0 0	140 0 0	
Shillong	...	...	"	7 25 0	76 10 0	
Darjeeling	...	...	"	20 27 8	206 29 0	

From the above table it will be found that Darjeeling gave a better outturn followed by local, but the drawback to the former is that it does not find an easy market in the district.

(E) *Wheat*.—Two varieties of wheat, Pusa No. 12 and Gangajali, were grown in 2.43 acres of land; but Pusa did not do well.

(F) *Sugarcane*.—The following varieties of cane were grown side by side on a plot of .91 acres of land to show the superiority of *Tanna* variety over all others. It is a hardy and prolific cane and immune from the ravages of wild animals—

Varieties:—

Yellow Tanna, Stripped Tanna, Red Mauritius. B. 147, B. 34, 12 and Dacca Gandari.

The *Tanna* canes were made into setts for further propagation.

II.—Experiments.

(a) Irrigation experiment on wheat and barley and oats was undertaken to find out whether these crops can be grown at a profit by resorting to irrigation, but this was obviated by the winter rains which made irrigation quite unnecessary.

(b) *Manurial experiment on potato*.—At the instance of the Director of Agriculture, Bengal, a series of manurial experiments on potato were arranged. This was undertaken with a view to find out if a special artificial fertiliser can economically be adopted as a substitute for castorcake which generally gets dearer during the potato season. The table below will show the results obtained:—

No. of sub-plot.	Manure.	Area in acre.	Actual outturn.	Outturn per acre.	Average out-turn per acre.	REMARKS.
			MDS. SR. CH.	MDS. SR. CH.	MDS. SR. CH.	
1	Fertiliser No. II	$\frac{1}{20}$	6 19 8	129 21 0	211 16 8	Average outturn per acre with fertiliser No. 1.
2	Cowdung ...	"	8 3 12	161 34 0	...	...
3	Castor cake ...	"	10 38 8	218 32 0	161 0 0	Average outturn per acre with fertiliser No. 2.
4	Fertiliser No. I	"	11 16 12	228 7 0	...	...
5	Cowdung ...	"	7 19 0	153 0 0	155 22 8	Average outturn per acre with cowdung.
6	Fertiliser No. 2	"	9 25 8	192 8 0	...	...
7	Do. No. 1	"	9 30 0	194 26 0	159 6 0	Average outturn per acre with castorcake.
8	Castor cake ...	"	4 39 0	99 21 0	...	...

(c) Pure line cultures with *kalai* and mustard were grown under the instructions of the Economic Botanist to the Government of Bengal in a plot of .33 acres.

(d) Spacing experiment of potato, 2 feet and 3 feet apart.—

Variety.	Area in acre.	Space between two rows.	Actual outturn.	Outturn per acre.	REMARKS.
			MDS. SR. CH.	MDS. SR. CH.	
Shillong ...	$\frac{1}{10}$	2 feet	7 25 0	76 10 0	
Do. ...	$\frac{1}{8}$	3 „	13 15 0	66 34 0	
Darjeeling ...	$\frac{1}{10}$	2 „	20 27 8	206 29 0	
Do. ...	$\frac{2}{3}$	3 „	61 13 8	153 16 0	

The above table will show that potato 2 feet apart gave a better outturn. In this district potato is generally grown not less than 3 feet apart between the lines. A series of experiments were conducted to find out if the spacing can be minimised without affecting the size of the tubers. Next season the spacing will be tried with local potato. This will be an useful demonstration to the district.

(e) *Flax*.—At the direction of the Fibre Expert to the Government of Bengal, this crop was grown in a plot of 50 acres. Seven maunds 10 seers of straw and 25 seers of seeds have been obtained.

Winter paddy.—*Indrasail* paddy was grown on 6.17 acres of land for multiplication. The results are given below :—

No. of Block.	Variety.	Area in acre.	Actual outturn.	Outturn per acre.	REMARKS.
			MDS. SR. CH.	MDS. SR. CH.	
3	<i>Indrasail</i> paddy	1.60	10 18 0	6 21 8	
3x	Ditto ...	.58	3 14 0	5 30 0	
4	Ditto ...	.80	5 39 0	7 20 0	
5	Ditto ...	1.60	18 35 0	11 32 0	
6 & 6x	Ditto ...	.40	2 18 0	6 4 0	
7	Ditto ...	.36	5 2 0	14 17 8	
10 & 11	Ditto ...	.83	4 2 0	4 35 0	

Crops for fodder (Jowar, khesari, oats and peas).—Jowar was grown on 4.15, Khesari on 6.17 and oats and peas (mixed) on 5.6 acres, and fed to cattle in the green stage.

Seed distribution.

6. Twelve maunds of *Kataktara aus* paddy, 16 maunds of *Indrasail* paddy and 2½ maunds of D.154 jute seeds were made over to the Superintendent of Agriculture, Rajshahi Division, for distribution.

Training of students.

7. Two men were trained in practical agriculture on this farm during the year under report.

Inspection.

8. The Director, the Deputy Director of Agriculture, the Economic Botanist and the Fibre Expert to the Government of Bengal visited the farm several times.

Establishment.

9. Babu Mohinimohon Ghose, the District Agricultural Officer, Rangpur, was in charge of the farm who was assisted by the Overseer, Babu Prafulla Ranjan Sen, during the year under report.

The farm was wellmanaged and Babu Mohinimohon Ghose is to be congratulated. Prafulla Babu also worked with his accustomed zeal.

Financial Statement of the Rangpur Demonstration Farm for 1920-21.

RECEIPTS.			
	Rs.	A.	P.
Amount credited into treasury ...	883	9	3
Add—Amount adjusted by book transfer.	109	0	0
	992	9	3
Add—Amount adjusted, <i>vide</i> Article 97, Civil Account Code for 1920-21.	10	0	0
Bills outstanding for 1920-21 ...	42	7	0
Value of stock in hand on 1st April 1921.	318	14	3
	1,363	14	6
Deduct—Value of previous year's farm produce sold and realised during the year.	160	2	9
	1,203	11	9
Amount adjusted by book transfer for previous year's farm produce.	28	10	0
Amount adjusted, <i>vide</i> Article 97, Civil Account Code for produce of previous years.	85	3	0
Bills outstanding for previous year's farm produce.	73	5	3
GRAND TOTAL ...	1,390	14	0

EXPENDITURE.			
	Rs.	A.	P.
1. Establishment ...	619	7	5
2. Contingencies—			
(a) Purchase and feed of cattle ...	305	8	6
(b) Purchase of seeds, manure and implements.	340	15	0
(c) Wages of labourers for cultivation.	1,643	5	6
(d) Wages of men who underwent training.	208	13	6
(e) Reclamation ...	98	6	0
(f) Petty construction and repairs	760	0	0
(g) Railway and steamer freight	8	5	0
(h) Cooly and cart hire	1	0	0
(i) Rent, rates, etc.	91	5	0
(j) Office expenses and miscellaneous.	188	7	6
Total ...	3,646	2	0
3. Add—Value of stock held over from previous year's stock.	72	13	6
GRAND TOTAL ...	3,718	15	6

B. T. DUTT,
Superintendent of Agriculture,
Rajshahi Division.

APPENDIX XVI.

ANNUAL REPORT OF THE BURIRHAT FARM FOR THE YEAR 1920-21.

Introductory.

Burirhat farm is situated on the border of a tobacco growing belt in the district of Rangpur and is 5 miles from Rangpur Town. The total area of the farm is 52 acres, of which only 28 acres of land are at present under cultivation, the rest being occupied by roads, drains and buildings, etc. The soil of the farm is a sandy loam with a sandy sub-soil. The water level of the sub-soil does not go deeper than 15 feet in the hot weather. The soil though originally very poor has since been greatly improved by systematic cultivation and proper manuring, and every part of the farm except a few patches is now capable of producing good crops.

Season.

The season was on the whole favourable for tobacco though the incessant rainfall in the month of August and September caused some difficulty in raising early seedlings and heavy showers of rain amounting to more than 15 inches in three days in the month of October caused great damage to the seedlings that were on the seedbed. The result of this was that a great scarcity of seedlings arose during the time of transplanting tobacco on plots prepared for that purpose.

These late heavy rains also encouraged insects (*Agratis Ypsilon*). The rainfall in the month of January 1921 was particularly favourable to the growth of tobacco, while showers in the month of March 1921 when the crop was nearly ready for harvesting was the cause of deterioration in the quality of tobacco leaves. This season is also marked by the absence of hot western winds which are necessary for curing local and cigarette tobacco.

Table showing the rainfall during the year :—

MONTH.	ACTUAL.		NORMAL.	
	Actual rainfall.	Number of rainy days.	Normal rainfall	Number of rainy days
	Inches.		Inches.	
April 1920	3.74	6	3.01	4.3
May "	4.56	9	10.66	11.5
June "	18.02	18	18.0	15.0
July "	8.39	13	15.89	15.0
August "	22.11	18	12.80	13.7
September "	30.55	19	14.24	13.3
October "	17.65	4	4.87	4.4
November "	Nil	Nil	0.12	0.2
December "	Nil	Nil	0.05	0.2
January 1921	1.52	3	0.05	0.9
February "	Nil	Nil	0.54	1.2
March "	2.26	4	1.25	1.8
	108.80	100	81.48	81.5

Areas under crops.

Bhadoi :—

Name.	Area.
(a) Cowpea for green manure	13.7
(b) Sunn hemp "	4.2
(c) Jower for fodder	1.9
(d) Aus paddy	8.2
Total	28.0

Rabi:—

1. Tobacco—

	Name.			Area.
I. Cigar wrapper	Sumatra	...	...	4.0
II. Cigar filler—				
(a)	Buchi (Madras)	...	...	.02
(b)	Nellore "	...	...	.02
(c)	Caulifiller "	...	...	.02
(d)	Havana	...	...	.03
	Total	...	...	4.09
III. Cigarette tobacco—				
(a)	White Burlay (American)	...	...	.15
(b)	Yellow prior "	...	...	.06
(c)	Orinoco	...	...	.06
(d)	Ayiasonlank (Turkish).	...	...	.03
(e)	Cavalla	...	...	.03
	Total	...	...	.33
IV. Local Tobacco—				
(a)	Bhengi	...	...	3.90
(b)	Nawkhal	...	...	.06
(c)	Matihari	...	...	.70
	Total	...	...	4.66
2. Oates and peas	...	...	...	15.35
3. Lentils	...	...	...	3.5
4. Rahar	...	...	...	.2
	Total	...	...	28.13

IV—Experiments.

1. Improvement of Sumatra tobacco for cigar wrapper.
2. Trials of American and Turkish varieties of tobacco for cigarette manufacture.
3. Improvement of local tobacco by selection.
4. Investigation of the manurial requirements for tobacco.
5. Comparative trials of the Economic Botanist's *Katakara* Aus paddy with local varieties.
6. Miscellaneous including the training of apprentices in manufacture of cigar, curing, etc.

Sumatra Tobacco.

The reputation of Sumatra leaf grown from the carefully selected seeds of this farm as a cigar wrapper has now been established in the market. The demand for Burirhat farm grown wrapper tobacco has greatly increased and the price offered by the Trichinopoly merchants varied from Re. 1 to 1-8 per pound. As the Sumatra tobacco grown by the farm as well as by the neighbouring cultivators was partly damaged by hail-storms last year we could not meet all demands. In the year under report there are four acres of Sumatra tobacco on the farm, and good crops are expected.

Bhengi tobacco.

This has proved itself to be the biggest yielder and fetches the highest price among the local varieties. There is a great demand of this tobacco by the Burmese traders who make from it the famous "Burma cheroots."

All experiments which are designed to ascertain the manurial requirements of tobacco is carried on with this variety and the results are appended later on in this report.

Improvement of seeds.

The selection of the best tobacco plants for seed purpose and the protection of them from cross pollination by bagging is being continued year after year with good results and the demand for such seed is increasing.

Investigation of manurial requirements for Tobacco.

Experiments were planned last year with a view to finding out the actual value of different kinds of manures with or without green manure and cowdung. The details of these experiments together with results obtained therefrom, are given below:—

EXPERIMENT I.**Crop :—Tobacco (Local Bhengi). Nature of experiment—Manurial.**

(This was designed to ascertain the comparative value of cowdung and green manuring with sunn hemp and cowpea. The effect of superphosphate in combination with these organic manures is also observed.)

Each plot $\frac{1}{20}$ th of an acre.

Plot No.	Nature of operation.	Actual green weight.			Green weight per acre.	
		Mds.	Sr.	Ch.	Mds.	Sr.
1.	Green manuring with sunn hemp	...	3	23 0	70	20
2.	Ditto with cowpeo	...	3	37 0	78	20
3.	One hundred maunds cowdung per acre	...	3	23 0	70	20
4.	Cowpea and 75 maunds cowdung per acre	...	4	18 0	89	0
5.	Ditto 60 lbs. of superphosphates	...	3	37 0	78	20
6.	Cowpea cut green and rolled in pits	...	2	29 0	54	20
7.	One hundred maunds cowdung per acre	...	3	0 0	60	0
8.	One hundred and fifty ditto ditto	...	2	23 8	51	30
9.	Two hundred ditto ditto	...	4	0 0	80	0
10.	One hundred ditto ditto	...	2	33 0	56	20
11.	Two hundred ditto ditto	...	2	21 6	50	27
12.	One hundred ditto ditto	...	2	28 0	54	0
13.	One hundred ditto ditto	...	2	13 0	46	20
14.	One hundred and fifty ditto ditto	...	2	14 0	47	0
15.	Cowpea + 60 lbs superphosphate	...	1	23 8	31	30
16.	Cowpea cut green and rolled in pits	...	1	21 0	30	20
17.	One hundred maunds cowdung per acre	...	2	24 0	52	0
18.	Cowpea + 75 maunds cowdung	...	3	6 0	63	0
19.	Green manure sunn hemp	...	3	29 4	74	25
20.	Green manure with cowpea	...	3	29 0	74	20

EXPERIMENT 2.**Crop—Tobacco (Local Bhengi) Nature of experiments—Manurial.**

(This is a similar experiment to the above, but here the results show the comparative effect of cowdung to sunn hemp as well as cowpea.)

Each plot $\frac{1}{20}$ th of an acre.

Plot No.	Nature of operation.	Actual green weight.			Green weight per acre.	
		Mds.	Sr.	Ch.	Mds.	Sr.
1.	Two hundred maunds cowdung per acre	...	2	23 4	51	25
2.	Sunn hemp rolled in pits	...	2	20 8	50	10
3.	Cowpea + 100 maunds cowdung per acre	...	2	28 8	54	10
4.	Sunn hemp + 100 ditto ditto	...	2	35 0	57	20
5.	Cowpea + 100 ditto ditto	...	3	11 8	65	30
6.	Sunn hemp + 100 ditto ditto	...	2	31 0	55	20
7.	Two hundred maunds cowdung per acre	...	2	22 0	51	0
8.	Sunn hemp rolled in pits	...	2	25 0	52	20

EXPERIMENT 3.**Crop—Tobacco (Local Bhengi) Nature of experiments—Manurial.**

(The following results show the value of addition of superphosphate and cowdung to sunn hemp as a green manure.)

Each plot $\frac{1}{10}$ th of an acre.

Plot No.	Nature of operation.	Actual green weight.	Green weight per acre.		
			Mds. Sr. Ch.	Mds. Sr.	
1.	Sunn hemp + 100 maunds cowdung per acre ...	5	32	8	58 5
2.	Sunn hemp + 50 maunds cowdung + 100 lbs. superphosphate per acre ...	4	10	0	42 20
3.	Sunn hemp + 100 maunds cowdung per acre ...	3	23	8	35 35
4.	Ditto + 50 maunds cowdung + 100 lbs. superphosphate per acre ...	5	6	0	51 20
5.	Ditto + 100 maunds cowdung ...	5	30	0	57 20
6.	Ditto + 50 maunds cowdung + 100 lbs. superphosphate per acre ...	5	11	0	52 30
7.	Ditto + 100 maunds cowdung per acre ...	5	7	8	51 35
8.	Ditto + 50 maunds cowdung + 100 lbs. superphosphate per acre ...	5	29	0	57 10
9.	Ditto + 100 maunds cowdung ...	4	34	0	48 20
10.	Ditto + 50 maunds cowdung + 100 lbs. superphosphate per acre ...	5	16	0	54 0

EXPERIMENT 4.**Crop—Tobacco (Local Bhengi). Nature of experiment—Manurial.**

(The following figures show the value of addition of tobacco stems and cowdung to sunn hemp as a green manure.)

Each plot $\frac{1}{20}$ th of an acre.

Plot No.	Nature of operation.	Actual green weight.	Green weight per acre.		
			Mds. Sr. Ch.	Mds. Sr.	
1.	Sunn hemp + 100 maunds cowdung per acre	2	19	8	49 30
2.	Ditto + 200 maunds rotten tobacco stem per acre ...	3	18	0	69 0

EXPERIMENT 5.**Crop—Tobacco (Local Bhengi). Nature of experiment**

(The following figures show best distances at which to plant Bhengi tobacco).

Each plot $\frac{1}{20}$ th of an acre.

Plot No.	Nature of operation.	Actual green weight.	Green weight per acre.		
			Mds. Sr. Ch.	Mds. Sr.	
1.	Planting in rows, 3' x 1' ...	1	25	8	32 30
2.	Ditto 3' x 3' ...	1	7	8	23 30
3.	Ditto 3' x 1' ...	3	1	0	60 20
4.	Ditto 3' x 3' ...	1	20	0	30 0

EXPERIMENT 6.**Crop—Tobacco (Local Bhengi). Nature of experiment—Manurial.**

(To test the effect of additions of oilcake and artificials to cowpea as a green manure below.)

Each plot $\frac{1}{20}$ th acre in duplicate.

Plot No.	Nature of operation.	Actual green weight.		Green weight per acre.	
		Mds.	Sr.	Mds.	Sr.
1.	Cowpea + 10 maunds of oilcake + 50 lbs. of superphosphate per acre ...	0	29	7	10
2.	Cowpea + 10 maunds of oilcake + 50 lbs. superphosphate + 50 lbs. of sulphate of ammonia ...	1	23	31	20
3.	Cowpea + 20 maunds oilcake ...	1	23	31	20
4.	Cowpea + 100 maunds cowdung per acre ...	1	27	33	20
5.	Cowpea + 20 maunds oilcake per acre ...	2	6	43	0
6.	Cowpea + 100 maunds cowdung per acre ...	1	30	35	0
7.	Cowpea + 10 maunds of oilcake + 50 lbs. superphosphate per acre ...	2	11	45	0
8.	Cowpea + 10 maunds oilcake + 50 lbs. superphosphate + 50 lbs. sulphate of ammonia ...	1	26	33	0

EXPERIMENT 7.**Crop—Sumatra Tobacco. Nature of experiment—Manurial.**

(This experiment was conducted to find out the manurial requirements of Sumatra tobacco particularly).

Each plot $\frac{1}{10}$ th acre in duplicate.

Plot No.	Nature of operation.	Dry weight actual.			Dry weight per acre.	
		Mds.	Sr.	Ch.	Mds.	Sr.
1.	Cowpea + 200 maunds cowdung ...	1	5	0	11	10
2.	Cowpea + standard mixture (K. P. N.) devised by Bombay Department of Agriculture ...	1	7	0	11	30
3.	Cowpea + 100 maunds cowdung + 336 lbs. superphosphate per acre ...	1	8	0	12	0
4.	Cowpea + 200 maunds cowdung per acre ...	1	3	0	10	30
5.	Cowpea + 100 maunds cowdung + 336 lbs. superphosphate per acre ...	1	5	0	11	10
6.	Cowpea + standard mixture (K. P. N.) as devised by the Bombay Department of Agriculture ...	1	10	8	12	25

K. P. N. contains :—

Sulphate of Potash—224 lbs per acre.

Ditto Ammonia—200 lbs „

Superphosphate—336 lbs. „

Experiment to test the effect of lime.

The following experiments were conducted to test the effect of lime alone or in combination with superphosphate and tank mud in reclaiming the barren lands which up to this time have not been capable of producing any crop :—

Crop—Oats.

Nature of Experiment—Manurial.

Each plot $\frac{1}{10}$ th acre in duplicate.

Plot No.	Nature of operation.	Actual green weight or straw with grain.			Outturn per acre	
		Mds.	Sr.	Ch.	Mds.	Sr.
1.	Ten maunds of lime and 20 maunds of tank mud per acre ...	2	13	0	23	10
2.	Cowpea + 10 maunds of lime + 50 lbs. of superphosphate per acre ...	1	27	0	16	35
8.	Cowpea + 100 lbs. superphosphate per acre ...	0	33	0	8	10
4.	Cowpea + 15 maunds lime per acre ...	1	8	0	12	0
5.	Cowpea + 100 lbs. superphosphate per acre ...	0	11	8	2	35
6.	Cowpea + 15 maunds of lime per acre ...	0	36	8	9	5
7.	Two hundred maunds pit mud and 10 maunds of lime per acre ...	1	10	8	12	35
8.	Cowpea + 10 maunds of lime + 50 lbs. of superphosphate per acre ...	1	23	0	25	30

Variety test on Aus paddy.

Previous crop—Cowpea followed by Sumatra tobacco.
Each plot $\frac{1}{10}$ th acre in duplicate.

Plot No.	Names of varieties.		Actual weight.			Outturn per acre.	
			Mds.	Sr.	Ch.	Mds.	Sr.
1.	Sonamail	...	2	1	8	20	15
2.	Kataktara	...	2	12	0	23	0
3.	Sonamail	...	1	37	0	19	10
4.	Kataktara	...	2	27	0	26	30
5.	Chapalo	...	1	22	8	15	25
6.	Kataktara	...	2	6	0	21	20
7.	Chapalo	...	1	9	0	12	10
8.	Kataktara	...	2	6	0	21	20

Distribution of seeds.

The demand for the selected seed was as high as it had been in the previous years but as most of the seeds grown for distribution were damaged by hailstorm we could not meet all demands excepting a small quantity amounting to 5 ozs. of Bhengi and 11 ozs. of Sumatra.

Miscellaneous—Practical training.

There are at present six apprentices under training in the cultivation and curing of tobacco as well as in the making of cigars. Some of them have already completed their one year's course. Three of the apprentices who were trained the year before last, have been appointed temporarily as tobacco demonstrators and are doing good work. One has taken service under the North Bengal Agricultural Development Company, Rangpur, and the other two are now working as assistants to the cigar-roller on this farm.

Manufacture of cheroots.

The demand for Burirhat cigars far exceeds the supply. From the statement given below it will be seen how rapidly the demand is increasing and this year more than Rs. 2,000 worth of cigars have been sold. At present there is not a single district in Bengal from which we are not receiving orders for cigars. Orders have also been received from the Punjab, Bihar and Orissa and Central Provinces. As our output is limited we cannot satisfy all. The following statement will show the rate at which the demand for Burirhat cigars is increasing :—

Year.	Amount realised.		
	Rs.	A.	P.
1916-17	...	15	2 0
1917-18	...	170	3 6
1918-19	...	507	1 0
1919-20	...	1,017	8 0
1920-21	...	1,994	6 6*

* Including Rs 281-11 outstanding.

Our cigar roller give demonstrations at the Faridpur, Natore and Daéca Social Service League exhibitions.

Cattle.

We have at present 17 bullocks in the farm. Two of the old bullocks died in the month of January on account of excessive cold and infirmity.

Construction and Laying out.

The principal construction work undertaken this year was the thorough repairs of the office buildings and the overseer's quarters costing Rs. 1,100 and Rs. 366-13-6 respectively.

Implements.

As in previous years, the spring toothed harrow and the planet junior hand hoe have proved to be very useful implements.

Visits.

This farm was this year visited by many distinguished persons including His Excellency the Governor of Bengal, the Commissioner of Rajshahi Division and the District Magistrate of Rangpur. It was also visited thrice by the Director of Agriculture, Bengal, by the Registrar of the Co-operative Credit Societies and other officers of the Department.

Establishment.

Babu Kamini Kumar Lahiri, B. Ag., was the Farm Superintendent throughout the year. He was assisted by one Overseer, one fieldman clerk and a tobacco curer.

Statement showing the receipt and expenditure of the Burirhat Farm during the year 1920-21.

Serial No.	Kind of proceeds sold.	Amount.	Detailed head of budget.	Amount.
		Rs. A. P.		Rs. A. P.
1	Sale of cigars ...	1,712 11 6	Purchase and feed of cattle ...	750 0 0
2	Tobacco ...	1,890 6 0	Purchase of seeds, manures and implements.	469 0 0
3	Tobacco seeds ...	27 6 0	Wages of farm labourers ...	3,800 0 0
4	Aus, paddy ...	212 3 3	Petty construction and repairs...	2,997 13 6*
5	Miscellaneous, such as fuel, lentil, potato, etc.	28 10 0	Railway and steamer freight ...	99 0 6
			Cost of medicine ...	49 0 0
			Service postage stamps and telegram charges.	90 0 0
			Reclamation ...	400 0 0
			Miscellaneous ...	969 0 0
	Total amount remitted into treasury Rs. 3,871-4-9	3,871 4 9		

* Including capital expenditure of Rs. 1,831-13-6.

Bills outstanding—	Rs. A.
1. For the price of cigars ...	281 11
2. " " aus paddy ...	85 0
3. " " refuse tobacco ...	6 4
	<hr/> 372 15

Value of the stock in hand—	Rs. A. P.
1. Cigar ...	109 0 6
2. Aus paddy ...	50 11 6
3. Tobacco ...	1,500 0 0
Total ...	<hr/> 1,659 12 0

J. N. SIRKAR,
Deputy Director of Agriculture,
Northern Circle.

APPENDIX XVII.

ANNUAL REPORT OF THE RAJSHAHI FARM FOR THE YEAR ENDING 31st MARCH 1921.

Introduction.

This farm with an area of 63 acres is situated at the headquarters of the Rajshahi district. The area under cultivation is 51 acres, the rest being occupied by roads, tanks, etc.

Improvement.

The plot C3 has been raised up by bringing earth from plot D6 which was an irregular high lying piece surrounding the washing tank. This arrangement was suggested by the Director of Agriculture, Bengal, during his last inspection with a view to consolidating the entire sugarcane area into one block.

A new godown for implements has been constructed at the back of the existing godown facing the road to facilitate the stocking of machines and implements.

The present implement shed with modifications and improvements has now been made suitable for the holding of meetings, etc.

Soil.

The soil of the farms was analysed by Dr. Leather in 1907, and shows a high percentage of lime and was incorporated in previous reports. Recently samples have been taken by Mr. M. Carbery, the present Agricultural Chemist; we hope to publish the results in next year's report, when it will be clear if there has been any change by this time.

Season and Rainfall.

Months.					Rainfall in inches, 1920-21.	Normal rain, fall in inches.	Rainfall in inches, 1919-20.
April	1920	...	...	...	Nil	10.80	0.38
May	"	...	...	...	2.20	5.56	2.38
June	"	...	...	...	6.73	10.81	8.30
July	"	...	...	...	10.86	11.45	13.26
August	"	...	...	...	6.41	10.75	12.82
September	"	...	...	...	9.90	10.40	13.31
October	"	...	...	...	3.38	4.46	2.85
November	"	...	...	...	Nil	0.31	0.42
December	"	...	...	...	Nil	0.06	Nil
January	1921	...	...	...	1.54	0.34	Nil
February	"	...	...	...	Nil	0.84	1.11
March	"	...	...	...	1.40	1.15	4.24
Total					42.42	66.93	59.01

Character of Season.

The weather was not very favourable for the sugarcane crop. Rainfall in February, which is the usual planting time, was nil. In March, however, 4.24 inches of rainfall helped the plantation. 2.3 acres could not be planted in time owing to drought and consequent lack of soil moisture. The planting of seedlings had, therefore, to be continued till July. There being no rainfall in April, the condition was also not favourable for *Bhadai* crops. Late rains in May and in subsequent months, however, improved the situation. So far as winter paddy is concerned, transplantation could not be carried out in time for want of proper rainfall. The deficiency of rainfall in July was to some extent made up by excessive rains in August. As there were no rains in October the crop failed. Thus the necessity of establishment of irrigation facilities is felt in this farm.

Rabi Crop.

Wheat.—Most of the wheat lodged and the ripe wheat deteriorated in quality. On the whole, the year was most unfavourable for these crops, and the results were not satisfactory.

Crops grown on the Farm.—The following is the rough programme of work done on the farm. Varietal tests with—

- (1) Sugarcane (Ratoon)
- (2) Plantation of cane for sets.
- (3) Jute propagation for seeds.
- (4) Manurial trials on potato.
- (5) Wheat for seed production.
- (6) *Aman* paddy for seed production.
- (7) Trials with cotton.
- (8) Varietal tests with *aus* crops.
- (9) Trials of Comilla arhar.
- (10) Seeds production of gram.
- (11) Khesari for fodder.

Exhibition.

Sugarcane.—The area under this crop was 9·23 acres out of which 3·43 acres were Ratoon (last year crop) dealing with varietal test of different varieties of cane. Out of 5·8 acres of canes newly planted in C1 (a) and (b) and C6 2·53 acres were planted in July. Thus the crop of the latter area was not at all satisfactory. Rest of the crop was fair.

Ratoon.

Area in acres.	Varieties.	Weight of canes.	Weight of juice.	Weight of gur.	Yield per acre.	REMARKS.
		Mds. SR. CH.	MDS. SR. CH.	MDS. SR. CH.	MDS. SR. CH.	
1 st Do.	Yellow Tanna ...	45 18 6	27 37 0	4 9 14	42 18 12	
Do.	Striped do. ...	42 24 11	28 30 0	4 27 8	46 35 0	
Do.	Vendamukhi ...	23 7 6	14 10 0	2 7 0	21 30 0	
Do.	Gandari ...	16 38 4	12 20 0	2 23 0	25 30 0	
Do.	B. 3412 ...	23 21 7	16 10 0	2 21 0	25 10 0	
Do.	B. 147 ...	28 3 10	19 20 0	2 39 8	29 35 0	
Do.	Khagri ...	37 36 4	21 30 0	3 10 8	32 25 0	

Average yield of plant canes per acre on C6 (the plot that was planted in time), 34 maunds 1 seer and 6 chattaacks.

The unsatisfactory crop on C1 and part of C6 accounts for the proportionate low yield of *gur*. 257,761 sets have been supplied this year for seed purposes.

Jute.

There were 3·72 acres under jute at the beginning of season, 7 acres being for fibres and the rest for seed. But 1·2 acres were ploughed up owing to very bad germination. The total yield of jute seed was 4 maunds 26 seers from 1·82 acres. Yield of fibres from 7 acres was 4 maunds 9 seers.

Aus paddy.

Kataktara aus paddy was grown this year again to compare its yield with that of two prolific local varieties. The results are given below:—

No.	Area in acres.	Name of the paddy.	Actual out-turn.	Outturn per acre.	REMARKS.
			MDS. SR. CH.	MDS. SR. CH.	
1	1 st acre	Morchibati ...	1 3 8	21 30 0	
2	Ditto	Kataktara ...	0 23 0	11 20 0	
3	Ditto	Morchibati ...	1 1 8	20 30 0	
4	Ditto	Kataktara ...	0 32 10	16 12 8	
5	Ditto	Morchibati ...	1 11 0	25 20 0	
6	Ditto	Kataktara ...	0 38 8	19 10 0	
7	Ditto	Morchibati ...	1 5 9	22 31 4	
8	Ditto	Kataktara ...	1 5 12	22 35 0	
9	Ditto	Do. ...	0 22 12	12 0 0	
10	Ditto	Kashiapanja ...	0 30 14	15 17 8	
11	Ditto	Kataktara ...	0 23 2	11 22 8	
12	Ditto	Kashiapanja ...	0 34 6	17 7 8	
13	Ditto	Kataktara ...	0 35 4	17 25 0	
14	Ditto	Kashiapanja ...	0 39 2	19 22 8	
15	Ditto	Kataktara ...	0 38 12	19 15 0	
16	Ditto	Kashiapanja ...	0 32 12	16 15 0	

Kataktara compares unfavourably and is usually not suited to local conditions.

The total area under *aus* paddy, including the Economic Botanist's experiment, was 12.46 acres giving a total yield of 196 maunds 11 seers 11 chittaks.

Aman paddy.

11.1 acres were put under *Indrasail* paddy. As has already been pointed out, the transplantation could not be carried out in time owing to the unusually late arrival of the rains, and transplanting could only be completed in September. The crop totally failed owing to the adverse weather. The total outturn obtained in 11.1 acres was only 58 maunds 32 seers 12 chittaks.

Potato.

1.24 acres were under potato which suffered very badly from *Rhizoctonia*. The results from the manurial plots shown in the following statement were not promising. Total yield of potato was 28 maunds 13 seers and 4 chittaks.

No.	Area.	Manure applied.	Outturn per plot.	Outturn per acre.	REMARKS.
	Acre.		Md. srs. ch.	Md. srs. ch.	
1	$\frac{1}{20}$ th	Artificial No. 1 ...	1 10 8	25 10 0	
2	Do.	Castor cake ...	1 13 8	26 30 0	
3	Do.	Artificial No. 2 ...	0 37 0	18 20 0	
4	Do.	Cowdung ...	0 23 4	11 25 0	
5	Do.	Artificial No. 1 ...	1 2 0	21 0 0	
6	Do.	Castor cake ...	1 9 8	24 30 0	
7	Do.	Cowdung ...	0 32 12	16 15 0	
8	Do.	Castor cake ...	0 37 12	18 35 0	
9	Do.	Cowdung ...	0 23 12	11 35 0	
10	Do.	Artificial No. 1 ...	0 24 10	12 12 8	
11	Do.	Castor cake ...	0 22 12	11 15 0	
12	Do.	Artificial No. 2 ...	0 16 0	8 0 0	
13	Do.	Cowdung ...	0 18 12	19 15 0	
14	Do.	Artificial No. 2 ...	0 39 0	19 20 0	
15	Do.	Castor cake ...	0 38 0	19 0 0	
16	Do.	Cowdung ...	0 31 8	15 30 0	

Wheat.

The total area put under wheat was 10.44 acres, out of which .6 acres were varietal tests with Pusa No. 4, Pusa No. 12, J. 90 and Kheri each in duplicate. Pusa No. 4 ripened first, and was earlier than the local Kheri by 25 days.

J. 90 suffered from an attack of rust (*Puccinia Glumarum*) and will be discontinued.

Statement showing the results of varietal tests of wheat (average of two plots).

Area.	Variety.	Actual yield.	Yield per acre.	REMARKS.
Acre.		Mds. sr. ch.	Mds sr. ch.	
$\frac{1}{20}$ th	Jabalpur No. 90 ...	0 8 14	4 12 8	Damaged by rust.
Do.	Pusa „ 4 ...	0 24 5	12 6 4	This was an early crop, ripened earlier by 25 days, and was decidedly superior in both main and check plot, the average of the two plots being here.
Do.	Do. „ 12 ...	0 15 12	7 35 10	
Do.	Kheri (local) ...	0 15 14	7 37 8	

N. B. — The seed of the different varieties was very mixed and re-selection will be necessary. Preliminary selection work on both wheat and gram has been started.

Introduction of Nari Plough.

Experiments with the Nari plough *versus* local plough were conducted. It was found that at a less cost the Nari plough gave a greater outturn and further trials will be made next year.

Khesari.

Khesari was grown over 11.1 acres as a second crop and grazed by farm cattle.

Seed distribution.

The following quantities of seeds were sold for seed purposes from the farm :—

		Sold.		Supplied.	
		Md.	Srs.	Md.	Srs.
(1) Pusa wheat No. 12	...	3	35	21	0
(2) <i>Indrasail</i> paddy	...	Nil		114	20
(3) Sugarcane cuttings	...	193,655	pieces	Nil	

Training of Apprentices.

An apprentice from Malda has recently been taken in for practical training. Two more young men, the sons of cultivators, are undergoing training especially in *gur*-making and sugarcane cultivation at their own cost.

Staff.

Babu Utpal Sarkar held the charge of this farm up till 21st December when Babu Charu Chandra Sanyal took over charge from him. Babu Jnanada Kanta Chaudhury was the Assistant Superintendent throughout the year. A new post of Overseer was sanctioned temporarily up to September last, and then again after five months it was re-sanctioned permanently. The post was filled by Babu Abani Mohan Das.

Visitors.

This farm was very frequently inspected by the Deputy Director of Agriculture and Divisional Superintendent. The Director of Agriculture, Bengal, visited the farm twice, Economic Botanist once, Fibre Expert once and Agricultural Chemist once. The farm was also visited by many private persons. The Collector of the district visited the farm several times.

Miscellaneous.

An exhibition was held on the farm on 23rd, 24th and 25th February. It was opened by Mr. Akshaya Kumar Maitra, C. I. E., and was attended by about 4,000 men, cultivators predominating.

Agricultural Education.

The students from Rajshahi College, on approval of the Director of Agriculture, were allowed to attend for special training in theoretical and practical agriculture. This movement was initiated by Dr. P. Neogi, Professor at the Rajshahi College who has shown much enthusiasm in the matter.

Receipts and Expenditure of the Rajshahi Farm.

RECEIPTS.				EXPENDITURE.				
		Rs.	A.	P.		Rs.	A.	P.
1. Sale-proceeds credited into the treasury	...	2,978	6	6	1. Valuation of stock brought forward	...	1,210	8 0
2. Bills outstanding (not yet over-due)	...	1,524	0	0	2. Cultivation	...	4,264	12 2
3. Valuation of stock in hand on the 1st April	...	1,162	0	0	3. Purchase of seeds, manure and implements	...	940	12 4
4. Valuation of seeds supplied to gift, seed store and farms	...	670	0	0	4. Purchase and feed of cattle	...	281	8 3
					5. Reclamation	...	745	1 0
					6. Petty construction and repairs	...	1,662	4 3
					7. Railway and steamer freight	...	221	2 3
					8. Cooly and cart hire	...	66	5 9
					9. Service postage stamp	...	80	0 0
					10. Cost of medical aid	...	24	11 6
					11. Miscellaneous	...	346	2 6
Total	...	6,334	6	6	Total	...	9,843	4 0

J. N. SARKAR,

Offg. Deputy Director of Agriculture, Northern Circle.

APPENDIX XVIII.

ANNUAL REPORT OF THE BOGRA AGRICULTURAL FARM FOR THE YEAR
1920-21.

The Bogra Agricultural Farm has been started with the object of testing locally the results achieved by scientific investigations in the central research stations at Dacca and Chinsura, and of studying the local problems of the district.

The farm consisting of 22·9 acres of land, of which 13·2 acres are under cultivation, the rest being occupied by tanks, buildings, roads and paddocks and situated on Charmichael Road on the western boundary of the Bogra town. The soil of the farm is a typical red laterite, and is representative of the western half of the district, where paddy is chiefly grown.

The lands were acquired in the year 1918-19 when construction of the buildings was taken up. The farm is provided with a combined office, godown and inspection room, District Agricultural Officer's quarters, three fieldmen demonstrators' quarters, cattle shed and a manure pit. It is enclosed by bamboo fencing, and a cooly shed is under construction.

The laying out of the farm was undertaken in 1919-20. The farm land, which was suitable for growing only winter paddy, has been so laid out with lands and drains that, leaving about half the farm area for winter paddy, the other half may be put under high land crops. The farm land has been levelled and is divided into $\frac{1}{16}$ acre plots.

Staff.

The farm is in charge of the District Agricultural Officer, Bogra, under whom three demonstrators work. The District Agricultural Officer worked hard in laying out the farm and had to contend with many difficulties.

Rainfall.

Recorded in the town during the year under report is given below :—

Month.	Normal.	For 1920-21.
April 1920	2·40	1·52
May "	8·66	5·48
June "	13·81	12·95
July "	13·40	10·79
August "	12·63	12·23
September "	10·97	13·44
October "	4·31	10·44
November "	0·60	Nil
December "	0·09	Nil
January 1921	0·42	1·13
February "	0·88	0·04
March "	1·11	Nil
Total	69·28	68·10

There was an actual deficiency up till the end of July, but this was made up by an excessive fall in October. Jute and Bhadoi crop suffered for want of sufficient rainfall during its growing season. The transplantation of winter paddy was finished very late owing to the scarcity of sufficient rain in time, but the crop was much benefited by the late rains in October.

The first cropping of this farm this year under report was with the Economic Botanist's selected *aus* paddy *Kataktara* and the Fibre Expert's selected Jute D. 154—for multiplication of seeds and for testing against local varieties. And the next crop raised during the year was the Economic Botanist's selected winter paddy—*Indrasail*—also with the above purpose. Under instruction of the Director of Agriculture, Bengal, some experiments have been taken up on irrigation of *rabi* crops, *viz.*, potato and wheat, and on raising fodder crops from this type of land (laterite paddy lands), a vast area of which is left fallow by the raiyats of the district after harvesting the winter paddy. Valuable crops, namely, sugarcane and potato, which are scarcely raised by the raiyats of this portion of the district, have been taken up this year. Better varieties of fruits, such as pineapple and mango, have been planted this year with a view to their introduction amongst the raiyats.

1. *Kataktara aus* paddy.—This was tried against two local popular varieties, *viz.* Inda and Sarisaputi, on 9 acres. Owing to poor germination and bad weather conditions no definite results could be obtained by the trial. The average yield per bigha was 2 maunds 11½ seers only.

2. *Jute D. 154*.—1·75 acres of the farm land were put under jute for the propagation of seeds only. No fibre was taken out. Two maunds and three seers of seeds were received per bigha.

3. *Winter paddy, E. B's Indrasail*.—This was tried against the prolific local variety also known as *Indrasail*. The outturn of Economic Botanist's *Indrasail* per acre was 22·5 maunds while that of local variety was 18·1 maunds only, *i. e.*, Economic Botanist's *Indrasail* gave an increased outturn of 4·4 maunds per acre over the local variety.

4. *Potato (Darjeeling)*. The result of the experiment on irrigation is given below—

	Yield per bigha.	Cost of irri- gation per bigha.	Increase of yield per bigha due to irriga- tion.	Net profit in money value per bigha.
	Mds. srs.	Rs.	Mds. srs.	Rs. A. P.
Irrigated plot (twice irrigated)	41 30	9	10 38	12 14 3 at Rs. 2 per maund
Non-irrigated plot ...	30 32	Nil	Nil	Nil.

The cost of irrigation per bigha was Rs. 4-8 for each time. The water was lifted from the tank by a *done*.

It therefore shows that by irrigation on potato the outturn may be increased by 10 maunds 38 seers per bigha, that is, by increasing an expenditure of Rs. 9 under the head irrigation a farmer can add to his income Rs. 12-14-3 (taking the price of potato Rs. 2 per maund) per bigha for his potato field. It may be mentioned here that the results would have been much more favourable had there been no late rain in October and a good shower in January, both of which are exceptional.

Wheat.

The three varieties, Pusa, Jabbalpur and the Gangajali wheat, were grown in the farm on 875 acres of land. They are not yet harvested.

Oats.

Were grown as fodder on 1·5 acres of land and were grazed down by the farm cattle.

Distribution of seeds.

11 maunds 2 seers 13 chittaks of jute seeds have been supplied from the farm during the year. 115 maunds 25 seers *Indrasail* paddy seeds have been kept in store for distribution.

Inspection.

His Excellency the Governor of Bengal visited the farm, and also the Hon'ble Minister in charge of Agriculture, in February 1921 and the Director of Agriculture, Bengal, in January 1921.

The Divisional Commissioner, the Deputy Director of Agriculture, Northern Circle, and the Collector of Bogra visited the farm on several occasions.

Receipts and Expenditure of the Bogra farm.

RECEIPTS.			EXPENDITURE.		
	Rs.	A. P.		Rs.	A. P.
Sale-proceeds of seeds			Purchase of cattle ...	1,000	0 0
credited to treasury ...	238	2 6	Feed of cattle ...	697	8 3
Bills outstanding ...	52	14 6	Purchase of seeds, manure and imple- ments ...	488	2 9
Stock in hand ...	460	5 3	Wages of labourers (both for farm work and reclamation of land) ...	1,195	8 6
(a) <i>Aus</i> paddy, 13 mds. 39 srs. 12 chs. at Rs. 3 per maund	41	1 0	Petty construction and repairs ...	1,600	12 3
(b) <i>Indrasail</i> paddy, 115 mds. 25 srs. 14 chs. at Rs. 3-8 per maund ...	404	11 9	Furniture ...	247	13 0
(c) Jute seeds, 11 srs. 11 chs. at Rs. 13 per maund ...	3	12 6	Railway freight ...	89	14 0
(d) Potato, 5 mds. 15 srs. at Rs. 2 per maund ...	10	12 0	Miscellaneous expenses ...	210	4 0
	460	5 3		5,529	14 9
Total ...	751	6 3	Less—Price of two pairs of bullocks made over to Rangpur Demonstra- tion Farm ...	377	0 0
			Total ...	5,152	14 9

B. T. DUTT,

Superintendent of Agriculture, Rajshahi Division.

APPENDIX XIX.

ANNUAL REPORT OF THE DEMONSTRATION FARM, ST. ANDREW'S COLONIAL HOMES, KALIMPONG, FOR THE YEAR 1920-21.

Introductory.

1. (A) *Situation and History*.—Kalimpong is the headquarters of the subdivision of Daling (a Government estate of 401 square miles), which was ceded to the British Government after the Bhutanese War of 1864-65.

It has a fairly large bazar, and is the mart for the produce of a considerable area, and is also the centre for Tibetan trade with Bengal.

The Demonstration Farm is situated below the Kalimpong bazar, on the south-easterly slope, which runs down to the Rilli river, a tributary of the Teesta, and is 12 miles from the nearest railway station, Kalimpong Road, which is on the Siliguri-Teesta Valley Extension of the Darjeeling-Himalayan Railway.

(B) *Area and Elevation*.—The farm was started with 24 acres of land in 1907 by the Homes for the benefit of the local cultivators and for the Homes boys, who were to be trained both for the Colonies as well as for agricultural work in India. This area has now been increased to nearly 75 acres, of which 11 acres are utilized by roads, coolie houses and farm buildings with some waste lands and plots growing trees and bamboos, leaving 64 acres for cultivation.

The elevation is as follows :—

				Feet.
Lower boundary	...	...	...	3,317
Farm buildings	...	...	...	3,673
Upper boundary	...	...	...	3,864

(C) *Irrigation*.—The only irrigation necessary for the paddy crops is obtained from the natural rainfall, and this consists of turning the water out of the many streams on to the rice terraces when required. For vegetable and fruit culture during the winter and dry season irrigation is arranged through pipes from natural springs, around which pucca stone vats have been built. These springs are situated in the heart of the farm and give a constant supply throughout the year for the whole establishment.

(D) *Character of the soil*.—The soil is a rich clay-loam, whose re-action is acid and is short of lime.

Meteorology.

2. The following table gives the normal rainfall for twelve years and that of 1920 at the Demonstration Farm :—

Month.					NORMAL 12 YEARS.		1920.	
					Rainfall.	Rainy days.	Rainfall.	Rainy days.
					Inches.		Inches.	
January 1920	...	...	...	...	0.28	1	...	...
February	"	...	...	..	1.00	4	0.14	1
March	"	...	...	...	1.56	5	0.47	5
April	"	...	...	...	2.41	9	1.57	5
May	"	...	...	...	5.48	16	3.91	12
June	"	...	...	...	20.74	21	13.82	26
July	"	...	...	...	25.77	25	21.88	27
August	"	...	...	...	20.16	25	6.12	22
September	"	...	...	...	12.28	18	20.92	14
October	"	...	...	...	3.50	6	0.48	2
November	"	...	...	...	1.07	2	...	...
December	"	...	...	...	0.06	1	...	...
Total					94.31	133	69.31	114
January 1921	...	...	...	...	...	...	1.75	3
February	"	...	...	...	...	...	...	...
March	"	...	...	...	...	...	2.27	4

From the above figures it will be noticed that the rainfall throughout the year under report was very deficient, and, in comparison to the figures recorded for the past twelve years we are about 25 inches short of the average. The season was unfavourable for practically every crop, and more or less they all suffered for want of the usual and timely rainfall.

Operation during the year.

3 (A) *General crops grown*.—The following table gives the area under each crop grown by the farm, and on the half-crop system, with the total outturn, yield per acre, cost of cultivation, price per maund (82 lbs.) and total value of crops :—

Crops.	Area, in acres.	Outturn, in lbs.	Yield per acre, in lbs.	Cost of cultivation per acre.	Price per maund.	Value of crops.	Grand Total.
				Rs. A.	Rs. A.	Rs. A. P.	Rs. A. P.
Maize	23'00	33,736	1,597	41 0	5 0	2,240 0 0	} 2,775 0 0
Half-crop maize ...	11'00	8,774	797	...	5 0	535 0 0	
Paddy (<i>aman</i>) ...	16'00	13,448	840	41 3	5 0	820 0 0	} 1,300 0 0
Do. straw ...	16'00	36,654	2,291	...	0 14	391 0 0	
Half-crop paddy ...	2'00	902	451	...	5 0	55 0 0	
Ditto straw ...	2'00	3,108	1,599	...	0 14	34 2 0	} 1,087 8 0
Kodo (Marwa) ...	8'00	14,760	1,845	57 3	3 12	675 0 0	
Half-crop Marwa ...	17'00	9,020	530	...	3 12	412 8 0	} 50 0 0
Ghaiya (<i>aus</i> paddy) ...	0'50	574	1,148	48 0	5 0	35 0 0	
Do. straw ...	0'50	2,460	4,920	...	0 8	15 0 0	} 6 4 0
Buckwheat ...	1'50	102	67	12 0	5 0	6 4 0	
Bhatmas (Soybeans)	4'00	1,264	316	29 7	6 0	92 8 0	92 8 0
Gahat	1'00	30	30	19 8	4 0	1 8 0	1 8 0
Dal Kalai	1'50	246	114	17 0	8 0	24 0 0	24 0 0
Mashyem ...	1'50	...	Failure	...	...	...	...
Potatoes ...	1'50	5,120	3,444	57 4	3 0	192 0 0	192 0 0
Sugarcane ...	1'25	5,699	4,556	147 9	14 0	973 0 0	973 0 0
Arrowroot ...	0'25	236	944	358 12	61 8	177 0 0	177 0 0
Khar (thatch grass) ...	1'50	12,669	8,446	18 0	0 8	77 4 0	77 4 0
Fruit culture ...	6'50	...	...	35 0	...	1,474 10 6	1,474 10 6
Vegetable culture ...	2'25	...	...	292 0	...	1,430 10 3	1,430 10 3

From the above figures it is evident that maize and Kodo (Crow's foot millet) in rotation are economically the most profitable crops for those hillsides. Kodo, Buckwheat, soybeans and various kinds of pulses are grown after maize on the same land in one year, but none of the latter-named crops is so popular as Kodo. Ghaiya or *aus* paddy does well on open slopes when sown in rows. *Aman* paddy is also cultivated on a profitable scale and good results can always be expected if a sufficient supply of water from the *jhoras* is constantly diverted into the paddy areas till the second week of October. The other crops, such as *kalai dal*, Soybeans, mashyem and various kinds of pulses, potatoes and buckwheat, etc., give unsatisfactory results and are not encouraging. Sugarcane for the manufacture of *gur* as well as for chewing purpose, also arrowroot, fruit and vegetable culture are very profitable and these are receiving special attention for introduction amongst the cultivators.

(B) Experimental work :—

Primary—

1. Maize.
2. Winter paddy (*aman dhan*).

Secondary—

3. Autumn paddy (*aus dhan*).
4. Kodo (Crow's feet millet).
5. Buckwheat.
6. Soybeans and *dals* (pulses).
7. Sugarcane.
8. Arrowroot, potatoes, fruit and vegetable culture.

1. *Maize (Zea Mays) veru, or Makai, Bhutta.*—Since 1907-08 experiments have been carried on year after year on this farm with a view to improving the quality of the maize and to retaining a few selected and true-to-type varieties, which are likely to give good results everywhere in the district. After many years of experiments and special attention devoted to this work, we have now on the farm six varieties, *i.e.*, Yellow Round, Yellow Flat, White Round, White Flat, Red Round and Sutton's Giant. These six varieties have been grown on large areas, and we find the seeds are very true to type and heavy yielders. Special attention is paid annually to the selection of our maize for seed purpose, whereby absolute true to type varieties of seeds are retained.

The average outturn of maize on 11 acres of all varieties under experimental cultivation for the past seven years is given below :—

				MDS. SRS. or lbs.		
1914-15	...	...	...	30	39	2,539
1915-16	...	...	...	31	26	2,615
1916-17	...	...	...	31	28	2,599
1917-18	...	...	...	28	35	2,367
1918-19	...	...	...	29	10	2,398
1919-20	...	...	...	30	19	2,498
1920-21	...	...	...	25	25	2,101

The above figures speak for themselves, showing the benefits to be derived from the careful selection and preservation of seed.

Seed was sown at the rate of 30 lbs. per acre between the third and fourth weeks of March and manure applied at the rate of 150 maunds or 12,300 lbs per acre. The crop was harvested from the beginning of the second week to the end of August.

(a) *Varieties.*—The variety experiment has given the following results for the last seven years :—

Variety Experiments.

Varieties.			OUTTURN PER ACRE.						
			1914.	1915.	1916.	1917.	1918.	1919.	1920.
Yellow Round	... { mds.	...	33 $\frac{3}{4}$	33 $\frac{5}{8}$	29 $\frac{1}{2}$	23	27	29 $\frac{1}{8}$	25 $\frac{1}{2}$
	... { lbs.	...	2,767	2,757	2,388	1,886	2,214	2,449	2,070
Yellow Flat	... { mds.	...	22	29	30 $\frac{3}{8}$	26	29 $\frac{1}{2}$	33 $\frac{3}{8}$	27 $\frac{3}{4}$
	... { lbs.	...	1,804	2,378	2,490	2,132	2,419	2,736	2,275
White Round	... { mds.	...	37	35 $\frac{1}{2}$	33 $\frac{1}{2}$	34 $\frac{1}{2}$	27 $\frac{1}{2}$	29 $\frac{1}{4}$	32 $\frac{3}{8}$
	... { lbs.	...	3,034	2,911	2,777	3,075	2,234	2,398	2,654
White Flat	... { mds.	...	31 $\frac{1}{2}$	23 $\frac{3}{8}$	37 $\frac{1}{2}$	37 $\frac{1}{2}$	32 $\frac{1}{2}$	34 $\frac{3}{8}$	30 $\frac{1}{8}$
	... { lbs.	...	2,562	1,947	3,054	3,075	2,665	2,839	2,470
Red Round	... { mds.	...	30 $\frac{1}{2}$	36	32 $\frac{3}{8}$	31	31	33 $\frac{1}{2}$	21 $\frac{3}{8}$
	... { lbs.	...	2,561	2,952	2,634	2,542	2,542	2,777	1,783
Sutton's Giant	... { mds.	...	...	...	10 $\frac{1}{2}$	15 $\frac{1}{2}$	20	25 $\frac{1}{2}$	23 $\frac{1}{2}$
	... { lbs.	...	...	...	881	1,250	1,640	2,060	1,906

These figures are from one acre blocks, and the figures backed up by the average from the farm require no comment.

(b) *Effect of Terracing.*—To compare the results of growing ordinary crops (not irrigated paddy) on terraced and untterraced land, 2 acres were selected as uniform in fertility and slope as was possible to find on the farm, each plot receiving similar treatment, equal amounts of manure and seeds being applied. —

The following table shows the outturn and cost of cultivation of maize and secondary crops for the last seven years :—

Terraced *versus* unterraced experiment.

TERRACED ACRE.			UNTERRACED ACRE.		
Crop.	Outturn.	Cost of cultivation.	Crop.	Outturn.	Cost of cultivation.
1914-15.	lbs.	Rs. A.	1914-15.	lbs.	Rs. A.
Maize	2,566	37 9	Maize	2,933	38 1
Buckwheat, local ...	358	14 9	Buckwheat, local ...	369	14 9
1915-16.			1915-16.		
Maize	2,829	33 5	Maize	3,308	33 8
Soybeans, Barmali ...	410	22 8	Soybeans, Barmali ...	287	22 0
1916-17.			1916-17.		
Maize	2,675	36 0	Maize	2,798	36 8
Kodo grains	1,886	46 0	Kodo grains	1,732	46 0
Straw estimated at Rs. 5.			Straw estimated at Rs. 5.		
1917-18.			1917-18.		
Maize	2,747	38 0	Maize	2,644	38 0
<i>Dal, Kalai—</i>			<i>Dal, Kalai—</i>		
Grain	481	23 0	Grain	502	23 0
Straw	984		Straw	1,025	
1918-19.			1918-19.		
Maize	2,644	36 4	Maize	2,419	36 2
Buckwheat, local ...	307	15 4	Buckwheat, local ...	317	15 6
1919-20.			1919-20.		
Maize	2,900	38 0	Maize	2,593	38 0
Soybeans, Barmali ...	381	26 0	Soybeans, Barmali ...	410	26 0
1920-21.			1920-21.		
Maize	2,716	41 10	Maize	2,470	41 6
Kodo grains	1,855	57 2	Kodo grains	1,998	57 2
Straw estimated at Rs. 5.			Straw estimated at Rs. 5.		

After ten years of experiments on these two acres, we find that during these past four years the terraced area has shown a marked improvement over the unterraced in the main crop, while it will be seen that the secondary crop has done better on the unterraced area.

(c) *Manurial experiments.*—Three plots of $\frac{1}{2}$ acre each have been reserved for these experiments since 1910-11. The condition of the soil in each plot is fairly uniform and the situation of each plot is approximately at the same level. For the past ten years this manurial experiment has been continued, and yearly the half acre with superphosphate, plus farmyard manure has given the best results of the three.

It was therefore decided to give up applying all manures on these areas and to work these three half acres as unmanured areas for three or four years, to find out the residual effects. This latter experiment was kept up for four years, but, as the results became unsatisfactory yearly, it has been decided to discontinue the experiment in future.

Ordinary mule manure, which we purchase at Rs. 2-8-6 per ton, is the most economical and effective, and this manure is chiefly utilized on the farm as well as by the surrounding cultivators.

The Yellow round variety of maize is extensively cultivated, and is a great favourite, being most profitable and popular with cultivators and merchants. The White round is another favourite, and both these two varieties are made into maize meal and eaten as porridge by the hill people as well as by Europeans.

The Red round is not cultivated much, although we find it one of our best yielders. There seems to be no market for it, and is chiefly given to poultry and animals.

The White and Yellow flat varieties are very well known by the hill people to be heavy yielders, but, as they get mildewed very easily, only a few raiyats cultivate them on fairly large areas in order to sell the crop soon after harvesting. The thin ends of the cob are usually open, and are therefore very accessible to weevils. Sutton's Giant maize "White flat" is also cultivated on this farm and has the same drawbacks as the two last-named varieties. The present demand for this seed is great.

(2) *Oryza Sativa*—*Winter paddy*—*Aman dhan*—*Transplanted paddy*.—Owing to the proximity of this farm to the hill ridge there is a collecting ground for water, and the crop in consequence is almost entirely dependent on the incidence of rainfall during these months of its growth.

The seed beds are sown by the third week in May, and transplanting commences by the end of June, and is completed by the end of July. The harvesting takes place soon after the first week of November and continues to the end of the month.

During the year under report three different kinds of experiments have been conducted with paddy, viz.—(a) *Elevation*, (b) *Variety*, (c) *Manurial*.

(a) *Elevation*.—This experiment with the Touli variety of paddy has been undertaken since 1915-16 in order to indicate at what altitude paddy would do best on the farm and the surrounding hillsides.

Elevation Experiment.

Serial No.	Area in acres.	Approximate elevation.	Variety.	Outturn in grain and straw.	Yield per acre.	Cost of cultivation.
		Feet.		lbs.	lbs.	Rs. A. P.
1	5.75	3,317—3,450	Touli.	7,380 G.	1,285 G.	261 12 0
				13,694 S.	2,380 S.	
2	3.0	3,550—3,650	"	2,460 G.	820 G.	139 0 0
				7,380 S.	2,460 S.	
3	2.33	3,500—3,700	"	1,824 G.	787 G.	112 4 0
				5,740 S.	2,463 S.	

During the past six years of this experiment it has been proved that the lowest elevation area has yielded the best results.

(b) *Variety*.—The following table shows the figures obtained for the last three years in connection with this experiment :—

Variety Experiment.

Variety.	OUTTURN PER ACRE.					
	1918-19.		1919-20.		1920-21.	
	Grain.	Straw.	Grain.	Straw.	Grain.	Straw.
	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.
Touli ...	1,435	2,952	1,394	2,583	738	1,968
Dhanasi ...	1,066	2,542	1,271	4,346	697	2,378
Mansara ...	1,599	3,034	1,681	3,280	697	1,804
Ratomarsi ...	1,558	2,870	1,763	3,321	1,076	2,460
Timurah ...	1,312	2,706	1,804	4,018	410	1,640
Ramtulsi ...	1,271	2,624	1,353	3,034	451	1,763

From the above figures it is difficult to judge which is the best yielder. Some varieties require plenty of irrigation and ripen earlier, while others do not, and when the rainfall is heavy or light, as the case may be, the varieties either suffer or give good outturns. On the whole Touli seems to be slightly the best and has many advantages, and this variety is cultivated chiefly on the farm.

(c) *Manurial*.—During the past 11 years an experiment has been conducted to note the effects of green-manuring, as compared with farmyard manure, and an unmanured plot with Touli variety of paddy.

The result of the last three years are here recorded :—

Manurial Experiment.

Manures.	OUTTURN PER ACRE.					
	1918-19.		1919-20.		1920-21.	
	Grain.	Straw.	Grain.	Straw.	Grain.	Straw.
	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.
(1) Unmanured ...	1,291	2,583	1,260	3,013	526	2,732
(2) 4,100 lbs. farmyard manure	984	3,075	768	3,597	309	2,173
(3) Green manured (Soy Beans)	1,414	2,767	1,383	3,259	557	1,968

From these figures there does not appear to be any advantage from farmyard manuring. Unmanured and green-manured areas have always given better results. It is never the practice to manure paddy areas on these hillsides, as the washings, etc., from above reach the fields from the jhoras.

(3) *Oryza Sativa*—Autumn paddy—Ausdhan or Ghaiya—unirrigated paddy.—This crop is usually sown broad cast on slopes thoroughly exposed to wind, air and well-drained. On the farm it is sown in rows of 18 inches and seeds dibbled in at 8 inches apart.

The result of the last three years are given below :—

				Grain.	Straw
1918-19	...	...	1 acre plot	902	6,560
1919-20	...	...	1 " "	1,189	4,920
1920-21	...	...	" "	1,148	4,920

There has been a slight decrease in the return due to unfavourable weather, and considering the outturn in grains per acre only 14 maunds, and straw 60 maunds this crop is cultivated at a profit, and there is a fair demand for the seeds by cultivators annually.

(4) *Eleusine Coracana*—Millet (Crow's foot)—Marwa—Kodo.—This crop grows in rotation with maize, and is transplanted from the third week in June to the end of July, so that when the maize crop is harvested in August the Kodo covers the land, having well developed in the intervals.

The following table shows the average outturn per acre from 1914 to 1920 from 6 acres of land under Marwa cultivated by the farm :—

Marwa outturn for seven years.

				lbs.
1914	...	...	...	1,886
1915	...	...	...	1,909
1916	...	...	...	1,640
1917	...	...	...	1,790
1918	...	...	...	2,099
1919	...	...	...	1,865
1920	...	...	...	1,980

During the past six years an experiment has been conducted to test the yield of two varieties, the curly closed and the open loose, both varieties of Marwa, which are cultivated extensively on these hills, and the results obtained are as follows :—

Marwa variety Experiment.

Year.	Variety.	Areas, in acres.	Outturn.	Cost of cultivation.	Value of crops.
			lbs.	Rs. A.	Rs. A. P.
1915-16	Curly closed	1	1,763	43 8	80 4 0
	Open loose	1	1,906	47 0	86 6 0
1916-17	Curly closed	1	1,804	45 0	65 8 0
	Open loose	1	1,937	47 8	70 0 0
1917-18	Curly closed	1	1,829	48 8	56 9 0
	Open loose	1	1,908	49 0	60 0 0
1918-19	Curly closed	1	1,906	49 0	80 9 0
	Open loose	1	2,009	49 8	84 10 0
1919-20	Curly closed	1	1,814	60 2	115 10 0
	Open loose	1	1,916	60 2	121 14 0
1920-21	Curly closed	1	1,998	57 6	91 6 6
	Open loose	1	1,962	57 6	89 12 3

The open loose variety seems to be the best yielder of the two, in spite of its shedding a good deal of its grain at the time of harvesting.

The straw is estimated at Rs. 5 per acre, and this is used for grazing. The grains were sold this year at Rs. 3-12 a maund late in March 1921 and this is about Rs. 2 less than last year's price.

To ascertain absolute true to type and the different varieties of Marwa that are grown in this district, special selection is being made from this year under report with the help and guidance of Mr. Hector, Economic Botanist, Bengal. The cultivation of these selected lines is being conducted carefully in the manner laid down by him.

(5) *Fagopyrum Esculentum*—*Buckwheat*—*Phaper*.—This is grown in rotation after maize. Seed is sown in the beginning of September and is ready for harvesting by the end of November. One-and-a-half acres were put under this crop, and, due to no rainfall in October and November at the time when the crop was in full blossom, the whole crop proved an utter failure.

(6) *Leguminous crops*.—The following crops belonging to this order are grown in this district and on this farm :—

Botanical name.	English name.	Nepali name.	Number of varieties.	REMARKS.
<i>Glycine hispida</i> ...	Soybeans ...	Bhatmas ...	6	Lepcha name Sil-liyan.
<i>Phaseolus Mungo</i> ...	Dal ...	Dai Kalai ...	3	
„ <i>Calcaratus</i> ...	„ ...	Mashyem ...	3	
„ <i>Sublobatus</i> ...	„ ...	„ ...	1	
<i>Dolichos biflorus</i> ...	.....	Gahat ...	1	This species is often called Gyrams.

(a) *Glycine hispida*—*Soybeans*—*Bhatmas*.—The following varieties were grown on the farm on 1 acre plot, and figures for the past seven years are given below :—

Soybeans.

Variety.	Area in acres.	1914-15.	1915-16.	1916-17.	1917-18.	1918-19.	1919-20.	1920-21.	REMARKS.
		Grains.	Grains.	Grains.	Grains.	Grains.	Grains.	Grains.	
		lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	
Nepali ...	1	1,681	820	1,148	902	1,148	1,517	1,025	Whole season crop grows alone.
Barmali ...	1	967	410	861	543	430	396	86	
White ...	1	...	...	...	...	463	349	34	Grows in rotation with maize.
Green ...	1	729	164	922	410	313	272	33	
Chocolate ...	1	799	635	820	656	522	615	502	
Black ...	1	676	440	984	797	635	410	275	

The first three varieties are erect growing, while the last three mentioned are of trailing habits.

All these six varieties of Soybeans can be grown in rotation with maize however. Nepali Bhatmas produces very little when grown along with maize, but when grown on a open slope yields heavily. The crop cannot, however, compete with maize or Marwa. The cost of cultivation of these crops was Rs. 29 per acre, except the Nepali variety which, when grown, alone cost Rs. 42 per acre. The value of the Nepali Soybeans was Rs. 8 per maund (82 lbs.) and of the other varieties at Rs. 6 per maund.

(b) *Kalai dal*—*Phaseolus Mungo*.—An area of 1.50 acres was cultivated with three varieties of this *dal* and an outturn of 114 lbs. per acre was obtained. This small return was due to the drought experienced this year under report. There is a great market for this *dal* and the price usually varies from Rs. 6 to Rs. 8 per maund. The cultivators usually sow this crop as well as Soybeans on the ridges or *ails* of paddy fields.

(c) *Phaseolus Calcaratus*—*Phaseolus Sublobatus*—*Mashyem Dal*.—Four varieties of this local *dal* was cultivated on 1.50 acres and the total crop was an utter failure due to drought.

(d) *Dolichos Biflorus*—*Gahat*.—An area of 1 acre was cultivated with this crop in rotation with maize, and an outturn of 30 lbs. only was obtained, due chiefly to

unfavourable weather. This grain is largely used by the hill people for medicinal purposes.

7. *Sugarcane—Saccharum Officinarum—Ukh.*—This crop takes 18 months to come to maturity on these hills as compared with 10 months on the plains. In April of 1916 a terraced area of 50 acre was planted with this crop, and since then has been increased to 1.25 acres. An outturn of 5,120 lbs., or 4,556 lbs. per acre of *gur* was manufactured at a cost of Rs. 147-9-3, and this was sold at Rs. 14 per maund. A clear profit of Rs. 630-4-9 per acre is obtained after paying all expenses. The cultivation of sugarcane seems to be the most profitable crop on the hills, either for manufacture of *gur* or for chewing purpose, as the crop grows with great success when ratooned, consequently the cultivation expenses are less. A local light yellow variety of sugarcane is being tried on a small scale from this year, to test the difference in yields of the two present varieties, which are called *gyanrah ukh* (similar to Red Mauritius) and *haray ukh*, which is like Bengal Shamshara.

Potatoes, etc.

8. (a) *Potatoes—Solanium Tuberosum—Alu.*—An area of 1.50 acres was planted with this crop in rotation after maize, and an outturn of 5,120 lbs., or 3,444 lbs. per acre, was harvested. Two varieties were cultivated—the red local and the white Sikkim; the former so far has always given the better result of the two. A number of new seedlings have been raised from Ryder's seed and good results are looked for.

(b) *Arrowroot—Maranta Arundinacea.*—An area of .25 acre was planted with this crop in April 1920 and the tubers were harvested in January and February 1921. Arrowroot was manufactured during these months, and a return of 236 lbs. or 944 lbs. was obtained at a cost of Rs. 358-12 per acre, while the value of the crop was Rs. 177, or Rs. 708 per acre. This is a very profitable crop, and it is being introduced amongst the cultivators very gradually.

(c) *Fruit culture.*—For this section of our work we have set aside an area of 6.50 acres (of which 3.02 acres is under the Darjeeling Improvement Fund, for supply of graftings, cuttings, etc., to the cultivators in the district free of cost) which is being cultivated with various kinds of fruit trees, tropical and sub-tropical, from Australia, Japan and from all parts of India. English fruit trees were tried, but with no success, due to the fact that our elevation is rather low and has a southern aspect. Careful experimental work has been taken in hand, to improve the quality, flavour and size of the local orange. The trees can be brought to full bearing within 5 or 6 years by budding on sour limes, etc., instead of the local practice of growing green seed.

(d) *Pineapples.*—An experimental area of half an acre under pineapples of the green variety was cultivated from 1912-13 till 1919-20, and as we had already received definite figures, which proved it to be a very profitable crop, this half acre was eventually uprooted during the year under report, as the land has become worn out. This crop has been planted out amongst the fruit orchards.

From sale of fruits and fruit trees, including pineapple suckers from the farm nursery, a sum of Rs. 1,474-10-6 was realized at a cost of Rs. 264, giving us a substantial profit of Rs. 1,210-10-6.

(e) *Vegetable culture.*—During the year under report 2.25 acres were placed under vegetable, and practically all varieties of foreign and Indian vegetables were cultivated in their respective seasons. Everything has been grown with more or less success, and a sum of Rs. 1,430-10-3 was received from the sale of these vegetables. The cultivation expenses, including the price of seeds and cost of manure applied for the 2.25 acres, was Rs. 657.

Our chief market has been Kalimpong, although a large quantity of various kinds of vegetables were sent to the Teesta Bridge Bazar in the winter months.

Our main object in taking up this cultivation on the farm is to introduce it amongst the raiyats of the Government estate and to put them in the way of exporting their produce to Calcutta at suitable times, as well as to provide for the needs of the coming hill station.

Distribution of seeds, etc.

9. The following list of seeds, etc., were distributed during the year 1920-21 :—

General—

1. Maize	...	...	...	2,624 lbs.
2. Paddy (<i>aus</i> and <i>aman</i>)	...	...	...	246 "
3. Marwa	...	...	...	59 "
4. Soybeans	...	...	...	389 "
5. Buckwheat	...	...	...	30 "
6. Dal	...	...	...	205 "
7. Potatoes	...	...	...	4,428 "
8. Sugarcane (rooted cuttings)	...	...	...	580 cuttings.
9. Arrowroot tubers	...	...	...	11 "

Vegetable—

1. Cabbage seeds	...	...	...	3,205 seedlings.
2. Cauliflower	...	...	19 oz.	1,810 "
3. Knol Khol	...	...	...	1,075 "
4. Tomatoes	...	...	...	220 "
5. Sikkim pea seeds	...	...	...	14 lbs.

Fruit trees—

Orange seedlings and <i>gooties</i>	...	...	372
Lime and lemon <i>gooties</i>	...	...	18
Pears	...	...	211
Peaches	...	...	28
Plums	...	...	46
Plantain	...	...	36
Papaya seedlings	...	...	60
„ seeds	...	...	5½ oz.
Grenadilas	...	...	18
Pineapple suckers	...	...	7,675
Guavas	...	...	178
Strawberry suckers	...	...	500

The above list of fruit trees also includes the number supplied from the Darjeeling Improvement Fund's Nursery, which is situated on the farm.

Miscellaneous.

10. (1) *Cattle*.—There are six pairs of draught bullocks kept on the farm, and the health of the animals have been very satisfactory. A large number of cultivators within a radius of 2 miles of the farm depend on our cattle to plough their fields for sowing their maize and paddy crops, and a sum of Rs. 108-3 was realized as plough hire during the year.

(2) *Poultry*.—Half an acre of land has been set aside for poultry rearing, and in this area five substantial houses have been erected with long wire, netted runs, and fruit trees planted in rows in these runs, to serve the purpose of giving shade for the birds. In the five houses the following strains of birds are kept:—

- (i) Pure white Wyandotte cocks with white Sikkim hens. Object—To obtain a hardy and good laying strain of birds suited to the hills.
- (ii) Buff Orpingtons. Object—To see how they would thrive up here and whether commercially they will be beneficial to the public.
- (iii) White Orpingtons. Object—Same as above.
- (iv) White Wyandottes. Object—Same as above.
- (v) Mixed strains of local, Sikkim and Chittagong birds are kept for the supply of broody hens, as these birds make the best mothers.

For the time being we intend to work without an incubator, consequently we are forced to keep the birds of No. 5 house for this purpose.

A sum of Rs. 1,101-6-3 has been spent by the farm during 1919-20 and 1920-21 for building of the poultry houses, the long runs fitted up with wire netting, cost of poultry from various parts of India, etc., and the sale-proceeds for the year 1920-21 amount to Rs. 234-8, *i.e.*, for sale of eggs and chickens to the general public.

Thirty-eight-and-a-half dozen of eggs were sold of both Wyandottes White and Buff Orpingtons and 41 chickens of over six months old of the above strains were also supplied for breeding purposes.

We had cholera and croup amongst our birds on two occasions, but the timely attendance and treatment given saved most of our birds from destruction, although I must say we lost heavily when we first introduced poultry-keeping, and the foreign strains suffered the most.

(3) *Practical Training*.—Lectures and practical demonstrations are given at various seasons of the year to the cultivators living within a radius of 5 miles of the farm, also to the boys and masters of the Normal School, in connection with the selection and preservation of maize seeds, manufacture of *gur* and arrowroot, fruit and vegetable culture, and instructions on entomology and mycology.

In addition, three boys from the Chittagong Hill Tracts are being trained on the practical side of agriculture especially the construction of terraces. A local educated hill man has been trained to work as a demonstrator for the Khasmahal in 10 blocks round the farm.

Four demonstration centres were opened this year under report in various parts of the Kalimpong Sub-division, and the names of the four centres are—Pedong, Git Byong, Nimbong and Yoke Pringtam, where some good work has been accomplished. A separate report on this work has also been submitted.

Visits and Inspections.

Sir Charles Stevenson-Moore, Sir Archie Birkmyre, D. H. Lees, Esq., I.C.S., Commissioner, Rajshahi Division, the Hon'ble Mr. Hornell, Director of Public Instruction, Bengal, J. A. L. Swan, Esq., I.C.S., and S. W. Goode, Esq., I.C.S., Deputy Commissioner, Darjeeling, visited the farm. G. Evan, Esq., M.A., C.I.E., Director of Agriculture, Bengal, inspected the farm in September and November 1920, while Mr. Hector, Economic Botanist, Bengal, and Rai Rajeshwar Das Gupta, Bahadur, Deputy Director of Agriculture, Northern Circle, paid several inspection visits.

Establishment and Management.

11. I was the Manager-in-charge during the year. The land for the farm was bought by the St. Andrew's Colonial Homes and is subject to an annual rental of Rs. 83-12. The farm is managed by the Homes and the Bengal Agricultural Department's grant of Rs. 5,000 *plus* half sale-proceeds is sufficient to pay for the upkeep. The remainder of the sale-proceeds is credited to the Homes.

The programme of work for this farm is drawn up with the help and sanction of the Bengal Agricultural Department.

Receipts and Expenditure.

12. A copy of the balance sheet for the year ending 31st March 1921 is given below :—

RECEIPTS.				EXPENDITURE.			
Amount.				Amount.			
	Rs.	A.	P.		Rs.	A.	P.
Government grant, 1920-21 ...	5,000	0	0	Labour ...	5,357	11	9
Sale of farm produce ...	9,072	13	9	Superintendence ...	2,930	10	0
Miscellaneous ...	396	9	0	Miscellaneous seeds,			
Loans from Homes for improve-				manures, repairs,	8,288	5	9
ments ...	3,570	0	0	postage, etc. ...		1,341	12 6
				Implements ...		118	5 3
				Capital outlay ...		3,051	4 0
				Half crops to Homes ...		4,536	6 9
				Insurance policy renewals ...		31	10 0
				Advertisement charges ...		20	9 0
				Loan repaid ...		650	0 0
				Balance in hand ...		1	1 6
Total ...	18,039	6	9	Total ...	18,039	6	9

The total value of produce sold shows a decrease of Rs. 1,114-11-9 as compared with that of last year. This is chiefly due to the low rates received from the sale of maize and marwa. The crops on the farm were also poor on account of unfavourable weather during this year.

Capital expenditure.

The farm was forced to borrow a sum of Rs. 3,570 from the Homes for the improvement of the Manager's house and office, the erection of five poultry houses and runs, etc., also building of 13 pucca vats and drains for the vegetable garden and the terracing of nearly 4 acres of land as suggested by Mr. Milligan. I had great hopes of repaying this sum back to the Homes from the sales of produce, but this could not be accomplished this year, as our sale-proceeds and returns were not what we had expected.

A sum of Rs. 650 only was repaid on this account, thus leaving a balance of Rs. 2,920 still due to the Homes.

We are again indebted to Mr. H. F. Green, Superintendent, Government Cinchona, Plantation, Munsong, for his kindness in valuing the farm stock, as at 31st March 1920 it was Rs. 2,436 as compared with 31st March 1921, Rs. 2,229.

HENRY R. EDMUNDS,

Manager, Demonstration Farm, Kalimpong.

APPENDIX XX.

ANNUAL REPORT OF THE VERNACULAR AGRICULTURAL SCHOOL, CENTRAL FARM, DACCA.

The school opened on the 15th January 1920 and after one month's vacation from 15th December 1920 reopened for the second session on 15th January 1921.

Control.

The school is under the direct control of the Deputy Director of Agriculture, Eastern Circle, who is advised on matters educational by the Inspector of Schools, Dacca Division.

Staff.

Mr. P. Biswas, No Gakushi, held the post of head master throughout the year and was assisted by Babu Himanshu Bimal Mukherjee and Maulvi Iyakub Ali.

Curriculum.

Certain deviations were made from the original curriculum first laid down. Books relating to agriculture being introduced when possible.

Practical work.

Each boy had a plot of two cottas allotted to himself which he had to cultivate with his own hands. The boys also worked as a community in producing the *aman* paddy crop and thereby learnt how to manage the plough.

The boys worked for one hour each day in the workshops learning elementary smithy and carpentry. They also received an elementary practical training in dairying.

Progress.

All the boys made excellent progress throughout the year. An extract from the Inspector of Schools' inspection note is given below :—

"I am of opinion that they have now developed considerably beyond the intellectual stage of the Middle English passed boy. They all, too, showed skill and readiness in the work on the farm and in the carpentry shop."

In their practical work the boys have shown keenness, and the work they have done shows distinct merit.

Mr. Biswas and the assistant masters are to be congratulated on the year's work.

Of the 30 boys originally admitted, 5 could not continue owing to illness or family affairs.

The non-co-operation movement, which pervaded Dacca Town, extended to the farm and whilst I was on tour the boys went on strike. On my return the next day they were given the option of leaving at once or returning to work immediately. All but six returned to work and the remaining six were brought back in a humbler state of mind within the next few days by their guardians.

K. MCLEAN,

Deputy Director of Agriculture.

APPENDIX XXI.

ANNUAL REPORT OF THE CHINSURA VERNACULAR AGRICULTURAL SCHOOL
FOR THE YEAR ENDING 31st MARCH 1921.

The Chinsura Vernacular Agricultural School was started from the first week of February 1921 and is situated on the Chinsura Agricultural Farm in the district of Hooghly. The object of the school is to provide instruction for the sons of cultivators without divorcing them from their traditional occupation.

Site and area.

It is situated in the north-west corner of the farm. The area of the school land is about 16 acres.

Buildings.

School and hostel buildings were made by the Public Works Department. Head Master's quarters, assistant teachers' quarters, workshops, sweepers' and malis' sheds are still to be built. In the hostel buildings accommodation was made for 30 boys—15 Hindus and 15 Muhammadans.

Staff.

One head master and one assistant teacher were appointed. The former Babu R. N. Roy, is a Hindu. He is a passed student of the Sibpur Agricultural class and has about 19 years' experience in the service of the Agricultural Department as Farm Superintendent, Lecturer in Agriculture, District Agricultural Inspector and Assistant Director of Agriculture. The assistant master, M. Ekramuddin Ahmed, is a Muhammadan. He is a passed student of the Normal School and has 8 years' experience in teaching work. He has also passed the *deshi kasrat* examination. The appointment of another assistant teacher for teaching carpentry and smithy is in contemplation.

Students.

There were 12 students on the roll on the 31st March 1921, of whom 7 were Muhammadans and 5 Hindus.

Curriculum.

The curriculum laid down which is exactly the same as for class V in middle vernacular school with the addition of field work, was adopted.

Medical arrangement.

There is medical supervision for the students and staff. The Sub-Assistant Surgeon who attends the farm staff 3 days in a week also attends the students and staff of the school.

Stipend.

Stipends of Rs. 10 per month is allowed for each pupil to meet feeding expenses.

Statement of account.

The sum of Rs. 4,209-6-2 was spent during the year under report in purchasing furniture, books, etc., and in paying the scholarships of the students and the contingency menials as shown in the table below :—

**Statement of accounts of Chinsura Vernacular Agricultural School
for 1920-21.**

Budget head.	Allotment (after reappropriation).	Expenditure.	Balance available.
	Rs.	Rs. A. P.	Rs. A. P.
Scholarship of the students ...	237	184 6 2	52 9 10
Pay of contingency menials ...	125	88 12 1	36 3 11
Purchase of furniture ...	2,300	2,300 0 0	...
Books for library ...	200	200 0 0	...
Seeds, manure and implements ...	400	135 2 6	264 13 6
Utensils, etc., for hostel contingencies...	1,400 {	521 14 3 } 779 3 2 }	98 14 7
Total ...	4,662	4,209 6 2	452 9 10

F. SMITH,

Deputy Director of Agriculture, Western Circle.

APPENDIX XXII.

ANNUAL REPORT ON SERICULTURAL OPERATIONS, BENGAL, FOR THE YEAR 1920-21.

The general control and management of the sericultural operations in Bengal were vested, as in previous years, in the Bengal Silk Committee, with the Director of Agriculture as President, and the Collectors of Malda and Murshidabad, Messrs. J. Goodman, J. deMinvielle and G. H. C. Ariff as members.

The Committee held two meetings during the year under report.

Administration.

I remained in charge throughout the year.

Disinfection of village rearing houses and raising seeds through the selected professional rearers.

The system of disinfection of village seed-rearing houses introduced in 1910 was continued but could not be extended further owing to the lack of adequate staff.

A post of Sericultural Inspector was created during the year with a view to exercising constant supervision over the selected professional rearers, more especially the students who have passed through the Sericultural School at Rajshahi. The Inspector will also work as an adviser to the village rearers and explain to them scientific methods of rearing by practical demonstrations. With the latter object in view a model rearing village has been started as an experiment at Goyespur near Malda town, where 10 rearers have been supplied with nursery seed at a reduced rate on the understanding that they should no longer rear village seed. The results obtained were highly satisfactory, not a single diseased worm having been found during the very first crop.

The popularity of the selected rearers' seed is increasing. During the year all their outturn obtained a ready sale in the market.

Tours.

I spent 260 days on tour and inspected the different nurseries and rearing villages as often as possible.

The points which engaged my special attention were :—

- (1) (a) Production and increase of disease-free seed from the Government nurseries.
- (b) Microscopic selection of seed by the examination of the moths kept for seed.
- (2) Supervision over the production of disease-free seed by the selected professional rearers.

All the selected rearers worked very satisfactorily and with increased energy. The eager demand for their seed amongst the professional rearers justifies their usefulness and popularity.

- (3) Comparisons were made between the results obtained from the nursery seed with those obtained from the selected rearers' seed and ordinary village seed.
- (4) Thorough disinfection both of the Government nurseries and of the houses of selected professional rearers.
- (5) Improvement of mulberry lands attached to the nurseries by manuring and good cultivation.
- (6) Extension of the area of mulberry lands.
- (7) Improvement of the ordinary village rearing houses by adding ventilators and windows and raising floors on the model of the nursery rearing houses. The continuous high price of wire gauze since 1916 did not allow much improvement in this direction.
- (8) The planting of "selected" mulberry cuttings which are less liable to the "tukras" disease in the Government nurseries and the supply of cuttings to the poorer raiyats free of cost.

The present condition of the silk industry in Bengal.

The demand for Bengal silk and the consequent high market is surely an indication that the industry is not doomed as was supposed twenty years ago. Since the year 1910, the silk market has been gradually rising and silk-rearing has turned out to be one of the most profitable concerns to the agriculturist. Cocoons which used to be sold at an average of Rs. 30 per maund as late as the year 1909 brought up to Rs. 90 during the year under review, and if the present high price continues, the future prospects of the industry seem to be assured.

The gradual development of the industry is also evident from the increase of area under mulberry throughout the silk-producing districts of Bengal. Though no proper census of mulberry was taken during the year, the total area under this crop is now estimated at 26,000 acres. The annual average outturn per acre being 360 kahans (1 kahan=1,280), the total yielding capacity of mulberry in Bengal would be about 9,400,000 kahans. One kahan of nursery seed cocoon generally yields on an average 102 kahans of cocoons, so about 92,000 kahans of seed cocoons are required to produce 9,400,000 kahans. Of these we have supplied during the year under review 19,698 kahans directly from the nurseries and approximately 8,000 kahans more, through the selected rearers working under the supervision of the Nursery Superintendents. Thus we have probably supplied about 29 per cent. of the seed required for the crop in Bengal.

Nurseries.

The following is a list and brief description of the Government nurseries worked during the year:—

(1) *Malda District.*—(a) Piasbari Central Nursery contains 5 big and one small rearing houses with 65 bighas 15 cottas of mulberry lands, of which 6 bighas are planted with selected mulberry at 3, 4, 5 and 6 feet apart. A further extension of the mulberry lands is under contemplation. This nursery contains many old tanks and ponds from which silt (Rhodes) is used in heavy dressings as manure for the mulberry.

The Director of Agriculture, with the members of the Bengal Silk Committee, visited the nursery on the 6th February 1921, with a view to ascertain the nature of work in the sericultural nurseries during their busiest periods. The visitors were shown all the working methods of nursery work, including the primary school attached to this nursery in which the principles of sericulture are taught.

(b) Amriti Central Nursery contains 4 large and 2 small rearing houses. The total area of mulberry lands attached to the nursery is 85 bighas 2 cottas, of which 2 bighas were newly planted during the year with the selected Punjabi variety at 5 feet apart in addition to 1 bigha 15 cottas which were planted similarly in 1919-20. Unfortunately nothing material could be done to improve the sanitary condition of this nursery for want of funds. The Director of Agriculture, Bengal, and the members of the Bengal Silk Committee who visited this nursery on the 5th February 1921, however were convinced of the necessity for improved sanitation on the nursery which is very malarious.

A lower primary school for the training of sons of professional rearers is being started at this nursery on the same lines as at Piasbari.

(2) *Murshidabad District.*—(a) Kumarpur Central Nursery contains 4 rearing houses with 39 bighas 14 cottas of mulberry lands, of which 2 bighas of old lands were replanted with new cuttings. Twenty bighas of lands contain selected mulberry at 5 feet apart and 7 bighas at 2½ feet apart. A further extension of mulberry lands is under contemplation.

(b) Chandanpur Central Nursery contains 4 rearing houses with 41 bighas 1 cotta of mulberry lands, of which 18 bighas 5 cottas are planted with selected cuttings at 4 or 5 feet apart.

During the year under report, an experiment to test the effect of different manures on mulberry was made at this nursery. No conclusive results were obtained and further trials are contemplated.

(c) *Berhampore Company Bagan.*—This was started during the year under review with an area of 22 bighas of lands for the upkeep of Chhotopoloo seed cocoons for supply to all the central nurseries for their winter crops. Ten bighas of land were newly planted in last October at 6 feet apart. A small rearing house with a temporary seed-cutting house has been constructed for the upkeep of Chhotopoloo seed cocoons during the winter months, when the temperature at Darjeeling falls abnormally low.

In the largest plot of 1 bigha 3 cottas, seven varieties of mulberry have been planted side by side, as a demonstration plot to show the difference in growth of leaves:—

(1) Deshi Cherra	...	...	...	3 rows (1 row planted and 2 rows to be planted in next June).
(2) Ordinary Deshi	...	...	...	4 rows.
(3) Punjabi Amritsar Cherra	...	...	...	4 "
(4) Punjabi Amritsar	...	...	...	4 "
(5) Punjabi Dehra-Dun	...	...	...	4 "
(6) Bombay	...	...	...	4 "
(7) Italian	...	...	...	3 "

Arrangements are also being made to accommodate nearly 300 mulberry trees along the broad roads within the area.

It was proposed to construct two rearing houses with quarters for the staff during the year under review. As funds were not available, this had to be postponed.

(3) *Birbhum district.*—Kalitha Central Nursery contains four rearing houses with 55 bighas of mulberry land, of which 14 bighas have been planted with selected mulberry at 4 and 5 feet apart.

The soil of the nursery is sticky and rocky, and improvement has proved a hard task. However, good results have been obtained by dressing the soil with river sand, which

has made cultivation easier and improved the mulberry by allowing the roots to penetrate deeper into the soil.

(4) *Rajshahi district*.—Mirganj Central Nursery contains five rearing houses with 55 bighas 17 cottas of mulberry lands. The condition of the soil is very poor and good dressings and manuring are therefore necessary. During this year 4 bighas 11 cottas of old land, which was full of gaps was up rooted and replanted with selected cuttings of the Dehra-Dun and Amritsar varieties.

(5) *Darjeeling Nursery*.—The Chhotopoloo seed supply has been transferred to Darjeeling where a house has been hired for rearing purposes and more than 3,000 cuttings have been planted on the waste lands in the neighbourhood of the Botanical Gardens.

Exchange of seed between the nurseries.

As in previous years Piasbari Central Nursery supplied Nistari seed cocoons to all other central nurseries in accordance with their requisitions, while Mirganj Central Nursery did the same to Piasbari and Amriti Central Nurseries.

The Chhotopoloo seed supply from the Kalitha Nursery in Birbhum was transferred to the Berhampore Company Bagan and Darjeeling Nurseries, and the Chhotopoloo seed for the winter crops of all nurseries was supplied directly from Darjeeling Nursery together with the Company Bagan Nursery.

The Berhampore Company Bagan and Darjeeling Nurseries are used to keep up Chhotopoloo seed, the main objects being—

- (1) to make seed cocoons spin early and late and to thus meet the requisitions of different nurseries according to their demands;
- (2) to ensure the greatest accuracy in the microscopic examination of seed (moths) by arranging to have a good interval between the spinning oviposition and hatching dates; and
- (3) to secure strong healthy seed by rearing in a cool temperature, as the Chhotopoloo worms are delicate.

The results from the Darjeeling Nursery seed have been splendid, and the professional silk worm rearers throughout Bengal have highly appreciated the favourable outturns obtained. In fact the success of the Chhotopoloo crop during last November is entirely due to Darjeeling Nursery and the credit of the Nistari summer crops of the year under report, is due to Mirganj and Piasbari Central Nurseries.

Supply of pure and disease-free Nistari and Chhotopoloo seed to the professional rearers.

The total receipts from the nurseries from 1st April 1920 to 31st March 1921 were as follows:—

				Rs.	A.	P.
From 19,698 K. seed cocoons	...	...	...	73,140	14	9
„ 1,526 cocoons	...	...	...	2,260	4	0
„ miscellaneous production	...	...	...	1,885	10	9
Total	...	...	...	77,285	13	6

The details of sale-proceeds of the outturn of each central nursery during 1920-21 are given below:—

Name of nurseries.	Seed.	Cocoons.	Miscellaneous.	Total sale proceeds.
	K. P. G.	K. P. G.	Rs. A. P.	Rs. A. P.
Piasbari Central Nursery	5,460 7 5	463 10 0	521 2 0	21,547 12 0
Amriti ditto	4,689 0 0	347 0 0	383 0 9	21,475 4 9
Mirganj ditto	2,408 13 4	134 11 0	162 9 6	9,374 13 9
Kumarpur ditto	2,784 0 0	339 8 0	108 11 0	10,291 8 0
Chandanpur ditto	2,212 11 5	34 6 0	139 9 6	7,872 4 0
Kalitha Nursery	2,144 0 0	207 0 0	151 12 6	6,306 5 6
Company Bagan Nursery	.....	.....	418 13 6	418 13 6
Total	19,698 14 14	1,526 3 0	1,885 10 9	77,286 13 6

The sale-proceeds for the four previous years are as follows compared with those of the year 1920-21:—

	Rs.	A.	P.
1916-17
1917-18 (from 1st July 1917 to 31st March 1918)
1918-19
1919-20
1920-21

The comparative fall in sale-proceeds during the year under review is due to the very severe and unprecedented drought which extended from April to June 1920, when the whole mulberry crop of Bengal was spoiled by severe heat and hot winds. Besides an accidental outbreak of muscardine at the Amriti Nursery during the most trying time and continued cloudy weather caused a loss of about Rs. 2,000.

The only ways of increasing the production of nursery seed are (a) extension of mulberry lands attached to the nurseries, (b) adequate manuring of lands, (c) extensive purchase of outside mulberry until sufficient lands are planted in the nurseries, and (d) construction of more rearing houses.

The total expenditure on the nurseries, including the office establishment from 1st April 1920 to 31st March 1921, is as follows :—

Details.	Amount.		
	Rs.	A.	P.
Salary of Superintendent of Sericulture, Bengal ...	6,119	5	8
Pay of establishment	24,150	3	10
Travelling allowance of Superintendent of Sericulture, Bengal	4,579	10	0
Travelling allowance of the staff	5,660	14	0
Petty construction and repairs	7,738	0	0
Rewards to nurserymen and sericultural students	450	0	0
Disinfection	3,875	11	3
Cultivation and rearing	71,563	6	11
Miscellaneous	11,837	1	3
Cost of microscopes	1,900	0	0
Rents, rates and taxes	2,585	14	1
Total	1,40,460	3	0

Sericultural schools.

The principles of scientific sericulture were taught to the professional rearers' sons at the Rajshahi Sericultural School.

Elementary lessons in scientific sericulture were also imparted to the little boys of the Piasbari Primary School. The Government grant-in-aid of Rs. 10 per mensem was continued.

Industrial Exhibition.

Sericultural operations were demonstrated at Suri and Dacca.

Co-operative Credit Societies.

Under the supervision of the Superintendent of Piasbari Central Nursery (Malda) the two banks (1) Piasbari Rindan Samity, (2) Mehedipur Alamtola Rindan Samity, flourished well. Under the jurisdiction of the Superintendent of Amriti Central Nursery (Malda) a new bank, viz., (1) Sonatala Basni Samity, was newly started in addition to (2), Modonpur Basni Samity, (3) Bangalgram Basni Samity. The Kumarpur Jautha Bank, under the Superintendent of Kumarpur Nursery (Murshidabad) also fared well.

Export Trade.—The statement below shows the quantities and value of silk, raw exported from Calcutta to foreign countries during the year 1920-21 as compared with last year's figures, was received from the office of the Collector of Customs, Calcutta :—

		lbs.	Value.
			Rs.
1919-20	(Raw silk)	21,494	3,07,010
Do.	(Chassam or waste)	322,932	3,40,580
Do.	(Cocoons)	12,500	19,530
1920-21	(Raw silk)	16,418	3,15,360
Do.	(Chassam or waste)	215,776	3,57,310
Do.	(Cocoons)	20,074	41,010

I specially acknowledge the good services rendered by the Nursery Superintendents, Babus Surendra Nath Bose, Benoy Krishna Nag, Sailendra Kumar Moulick, Amulya Chandra Dutta, Abani Mohan Sarma, Gobinda Nath Roy and Shishir Kumar Guha, who have done their utmost to keep up the good reputation of the Government Nursery seed during the year under report. I hope they will continue to do so in future.

A. C. GHOSH,

Deputy Director of Sericulture, Bengal.

APPENDIX XXIII.

REPORT ON THE WORK DONE AT THE SERICULTURAL RESEARCH STATIONS
(BERHAMPORE, KURSEONG AND KALIMPONG) DURING THE YEAR 1920-21.

Comparative field-scale rearing tests.

The field-scale rearing of promising hybrids and pure indigenous varieties was continued as in the last year. The results are shown in the comparative statements appended to this report.

In the following table an attempt has been made to compare the relative yield of silk of the indigenous Nistaris and two of the more promising hybrid varieties when subjected to field-scale rearing tests. The unit of cocoons in each case has been taken to have been 25,600 cocoons or 20 *kahans* :—

Period of rearing.		Hybrid No. 1.	Hybrid No. 4.	Pure Nistari.
		seer	seer	seer
March—April	1918	2.00	1.81	1.56
April—May	"	2.50	1.63	1.44
May—June	"	1.80	1.60	1.25
July—August	"	2.00	2.16	1.47
September—October	"	1.56	1.50	1.25
October—December	"	1.80	2.00	1.84
March—April	1919	1.69	1.75	1.56
April—May	"	2.20	2.38	2.00
May—June	"	1.32	1.50	1.25
July—August	"	1.60	1.67	1.56
September—October	"	1.75	1.19	1.00
October—December	"	1.50	1.56	1.56
March—April	1920	1.90	1.50	1.69
April—May	"	1.06	1.12	0.92
July—August	"	1.15	1.20	0.94

For the year 1920-21, only three rearings are shown. This is due to the fact that the various lots under these field-scale rearing tests had gradually varied in their ages in the course of the successive rearings, so much so, that since September there has been a difference of about one month in some cases. Consequently it was necessary to postpone field tests from September to December so as to sort out identically spinning lots. Since March 1921 we have been able to derive such lots to insure comparison. Fresh lots from the main stock could not be used without detriment to the previous experiments as the lots subjected to field test were reared in the plains without being sent to the hills since March 1918, unlike the main stock lots which are reared in the hills from March to October every year. So in order to preserve connection with the previous experiments for the purpose of comparative study it was necessary that the stock should be derived from the lots subjected to field tests.

The following average figures for the crops, from March 1918 to April 1920, noted in the above table, show that the hybrids Nos. 1 and 4 are on the whole more efficient than the indigenous Nistaris as regards their silk-yielding capacity :—

- (1) Hybrid No. 1, yielded on an average 1.82 seers of silk from 20 kahans of cocoons and showed an increase of 22 per cent. over the yield of the Nistaris.
- (2) Hybrid No. 4 yielded on an average 1.71 seers of silk from 20 kahans of cocoons and showed an increase of 14 per cent. over the yield of the Nistaris.
- (3) The indigenous Nistaris, taken to be the normal for comparison, yielded on an average 1.5 seers of silk from 20 kahans of cocoons.

It is quite evident from the above table that the yield of silk is controlled to very great extent by factors other than inherent qualities. In spite of the fact that the race had shown a poor yield in one crop it does not necessarily follow that the yield will be poor henceforth. The results show that the yield may be very high in spite of poor yields in a previous crop. So that the average figure for all the crops in a year cannot possibly afford correct estimation of the efficiency of a race. To estimate the race at its best it would be necessary to determine the favourable period of rearing for that particular race. In fact by a careful study of the favourable period of a particular race the different rearings during the year could be arranged in such a manner as to rear the particularly suitable and best-yielding variety for that particular season. From the figures at our

disposal at present it is not yet possible to draw any such conclusion without further corroboration. But it is evident that the maximum yield in the case of the hybrids excel the Nistaris considerably.

Village tests.

In view of the higher average figures of the Hybrid No. 1 and Hybrid No. 4 it was considered useful to subject these varieties to rearing in two villages so as to test their comparative efficiency under village conditions. The percentage of yield per laying was considerably affected by flies and muscardine, but the standard for the hybrids was higher than the Nistaris reared in the neighbouring villages. The difficulty noted with regard to the maintenance of uniformity in dates of spinning had been considerable, and in fact the results hitherto studied cannot be considered satisfactory. This was due to the fact that the dates of spinning required did not meet the demands of both the villages as they could not arrange their production of leaf accordingly. The reeling figures for village-rearing may be taken to have been 18 kahans to a seer of silk for the hybrids against 21 kahans to a seer of silk for the Nistaris. This showed an increase by 20 per cent. in the yield of silk for the hybrids.

Since February 1920 we have been able to select out two villages wherein the rearers have agreed to rear according to the dates of spinning required by us so as to obtain more correct estimation on the different points.

Experimental work.

The rearing of the stock races, both hybrid and pure, by the method of selection and family rearing are being continued so as to derive the best yield by the selection of the maximum yielders. The points regarding the suitability of change in the hills from March to October were fully discussed in my previous reports and in fact the necessity of such changes cannot be ignored. In Bengal the conditions of rearing from May to September is far from satisfactory. The univoltine as well as superior foreign multivoltines, such as Madagascar, worms cannot resist such climatic conditions and consequently die in numbers. The yield of silk from the corresponding rearing in the hills is higher than in the plains. Consequently we have determined by a series of trials that the races should be reared in the hills from March to October so as to avoid any risk of degeneration. Each stock lot is reared at hill nurseries at Kurseong and Kalimpong during this period.

Since last year we have done a good deal of work in connection with the rearing of the pure univoltine breeds in Kurseong. From the outturn of the rearing in Kurseong we had kept a number of univoltine layings all along in Kurseong for hibernation without adopting any artificial means for the raising or lowering of temperature. The results with the Chinese white had been satisfactory in that the eclosion has been perfect with the eggs which had hatched out by the middle of March 1921. The results with the Kashmir layings have not been so satisfactory. Attempts are being made to have a good supply of superior stock in hand in the hills so as to utilise them for hybridising purposes. It may be stated that the original stock races, from which we had derived our moths for the evolution of Hybrid No. 1 and Hybrid No. 4 referred to previously, were received in very bad condition by post. A good many worms had hatched out in the journey. So since last year attempts at new crossings in the light of the experiences of the past were made, and at present we have derived two multivoltine hybrids which are behaving as multivoltines and are at present at the eighth generation. Unfortunately the attempts in obtaining pure Madagascar multivoltine failed even this year as all the worms had died en route without even a single exception.

The experiments on the improvement of the indigenous Nistaris and Chhotopolo by the method of selection for the rearing of maximum yielders have shown very satisfactory and progressive results. The effect of the change in the hills was also favourably pronounced.

Sericultural School.

Six students selected from the rearing classes were granted stipends for study in the Sericultural School attached to the Research Station at Berhampore. Five of these students were granted the reward of Rs. 250 each on passing the school final examination for constructing rearing houses according to the plan approved by the Department.

PRABHAT CHANDRA CHAUDHURI,

Superintendent of Sericulture, in charge

Sericultural Researches.

***STATEMENT XIII.**

Data regarding different races of silkworms reared at the Berhampore Sericultural Research Station during March-April crop, 1920.

Name of race.	No. 1, 44th generation.	No. 4, 44th generation.	Nistari.	J. 303, 77th generation.,
1. Date of spinning of seed-cocoons.	$\frac{21}{22}$ -2-20	$\frac{12}{13}$ -2-20	$\frac{13}{14}$ -2-20	7-1-20
2. Date of cutting out of moths.	$\frac{1}{2}$ -3-20	$\frac{27}{28}$ -2-20	$\left\{ \begin{array}{c} 29-2-20 \\ \text{to} \\ 1-3-20 \end{array} \right\}$	$\frac{29}{28}$ -1-20
3. Date of examination of moths.	$\frac{10}{11}$ -3-20	$\frac{4}{5}$ -3-20	6-3-20	6-2-20
4. Total number of moths	1,847	1766	327	147
5. Number of dead moths rejected.	542	537	78	32
6. Total number of moths examined.	1,279	1,202	287	87
7. Number of moths rejected for Pebrine.	77	61	40	6
8. Number of moths rejected for Flacherie.	630	541	87	30
9. Number of disease-free moths.	572	600	100	51
10. Number of improperly laid layings rejected.	26	27	22	28
11. Number of layings rejected for univoltine tendencies.	Nil	Nil	Nil	Nil
12. Temperature during seed-cutting period.	80° F.	80° F.	80° F.	66° F.
13. Number of layings reared	387	600	100	50
14. Average number of eggs per laying.	325	300	250	231
15. Date of hatching ...	$\frac{15}{16}$ -3-20	$\frac{9}{10}$ -3-20	$\frac{11}{12}$ -3-20	$\frac{17}{18}$ -2-20
16. Date of spinning ...	$\frac{19}{11}$ -4-20	$\frac{4}{3}$ -4-20	$\frac{9}{7}$ -4-20	$\frac{23}{24}$ -3-20
17. Temperature during rearing.	75° F.	75° F.	75° F.	67° F.
18. Total outturn of cocoons	77 k. 4 p.	129 k. 14 p.	16 k. 7 p.	5 k. 10 p.
19. Disposal of outturn :—				
(a) Quantity kept for seed.	6 k.	13 k.	2 k. 8 p.	4 p.
(b) Quantity kept for sample.	4 pons	4 pons	4 pons	4 pon.
(c) Quantity kept for cocoons for reeling.	71 k.	99 k.	13 k. 13 p.	5 k. 4 p.
20. Total quantity of leaves used.	8,199 lbs.	13,720 lbs.	1,664 lbs.	553 lbs.
21. Quantity of leaves rejected (tender, too hard, dusty, etc.).	474 lbs.	600 lbs.	86 lbs.	40 lbs.
22. Quantity of leaves consumed.	7,725 lbs.	13,120 lbs.	1,578 lbs.	513 lbs.

* The statements are numbered in continuation of those appended to the report for 1919-20.

***STATEMENT XIII.**

Comparative figures for different races of silkworms reared at the Berhampore Sericultural Research Station during March-April crop, 1920.

Name of race.	No. 1, 44th generation.	No. 4, 44th generation.	Nistari.	J. 303, 77th generation.
1. Mr. J. de Minvielle's reeling tests—				
(a) Silk in 80 sicca ...	6 srs. 12 ch.	7 srs. 9 ch:	1 sr. 2 ch.	5 ch.
(b) Quantity of cocoons reeled.	71 k.	99 k. 10 p.	13 k. 13 p.	5 k. 4 p.
(c) Kahans of cocoons required per seer of silk.	10 k. 8 p. 6 g.	13 k. 2 p. 15½ g.	12 k. 4 p. 9 g.	16 k. 12 p. 16 g.
(d) Chassam or floss ...	1 sr. 15 ch.	1 sr. 15 ch.	10 ch.	2 ch.
2. Comparative estimation—				
(a) Percentage of dead moths.	29·34	30·4	23·85	21·76
(b) Percentage of Peb-rine.	6·	5·	13·93	6·88
(c) Percentage of Fla-cherie.	49·25	45·	30·31	34·48
(d) Percentage of disease-free moths.	44·72	49·91	34·84	58·62
(e) Percentage of yield per laying.	78·61	92·13	84·16	62·33
(f) Number of layings yielding one kahan outturn.	5·	4·61	6·	8·88
(g) Leaves consumed per kahan outturn.	100 lbs.	100·82 lbs.	96 lbs.	91·2 lbs.
(h) Leaves required for cocoons to yield one seer reeled silk (calculated from Mr. de Minvielle's figures).	1,051·87 lbs.	1,328·14 lbs.	1,178·9 lbs.	1,532·16 lbs.
(i) Number of cocoons weighing one seer on the 3rd day after spinning.	11 p.	10 p. 10 g.	11 p. 10 g.	14 p. 10 g.
(j) Average weight of one cocoon (with chrysalis) on the 3rd day after spinning (200 readings).	17·14 grs.	17·9 grs.	17 grs.	13·4 grs.
(h) Average weight of silky substance in one cocoon (with-out chrysalis) on the 3rd day after spinning (200 readings).	2·25 grs.	2·5 grs.	2 grs.	2 grs.
3. Variational features observed—				
(a) Larval markings ...	...	...	...	...
(b) Colour of cocoons	Yellow	Yellow	Yellow	Pale Yellow
(c) Any other features	...	...	...	...
4. Remarks .. ...	...	...	...	...

* The statements are numbered in continuation of those appended to the report for 1919-20.

STATEMENT XIV.

Data regarding different races of silkworms reared at the Berhampore Sericultural Research Station during April-May crop, 1920.

Name of races.	No. 1, 45th generation.	No. 4, 45th generation.	J. 303, 78th generation.	Nistari.	Chotopoloo.
1. Date of spinning of seed-cocoons.	10-4-20	4-4-20	$\frac{23}{24}$ -3-20	10-4-20	$\frac{29}{30}$ -3-20
2. Date of cutting out of moths.	$\frac{19}{20}$ -4-20	$\frac{13}{14}$ -4-20	$\frac{2}{3}$ -4-20	$\frac{18}{19}$ -4-20	$\frac{2}{10}$ -4-20
3. Date of examination of moths.	$\frac{25}{26}$ -4-20	$\frac{19}{20}$ -4-20	7-4-20	$\frac{24}{25}$ -4-20	$\frac{13}{14}$ -4-20
4. Total number of moths.	2,265	2,458	158	1,064	1,080
5. Number of dead moths rejected.	595	468	12	162	70
6. Total number of moths examined.	1,640	1,964	142	865	975
7. Number of moths rejected for Pebrine.	83	107	9	48	57
8. Number of moths rejected for Fla-cherie.	632	847	33	252	458
9. Number of disease-free moths.	925	1,010	100	565	460
10. Number of improperly laid layings rejected.	30	26	4	37	35
11. Number of layings rejected for univol-tine tendencies.	...	...	...	...	...
12. Temperature during seed-cutting period.	80°F.	80°F.	80°F.	80°F.	80°F.
13. Number of layings reared.	558	1,000	100	460	460
14. Average number of eggs per laying.	395	315	269	300	278
15. Date of hatching ...	$\frac{27}{28}$ -4-20	$\frac{21}{22}$ -4-20	11-4-20	$\frac{26}{27}$ -4-20	$\frac{17}{18}$ -4-20
16. Date of spinning ...	$\frac{23}{24}$ -5-20	$\frac{17}{18}$ -5-20	4-5-20	$\frac{23}{24}$ -5-20	$\frac{17}{18}$ -5-20
17. Temperature during rearing.	85°F.	85°F.	82°F.	85°F.	82°F.
18. Total outturn of co-coons.	111 k. 6 p.	213 k. 4 p.	15 k. 13 p.	79 k. 2 p.	56 k. 2 p.
19. Disposal of out-turn :—					
(a) Quantity kept for seed.	15 k.	4 k.	1 k. 3 p.	2 k.	2 k.
(b) Quantity kept for sample.	4 p.	4 p.	2 p.	2 p.	2 p.
(c) Quantity kept for cocoons for reeling.	96 k. 2 p.	209 k.	14 k. 8 p.	77 k.	54 k.
20. Total quantity of leaves used.	9,972 lbs.	18,686 lbs.	1,920 lbs.	6,650 lbs.	4,704 lbs.
21. Quantity of leaves rejected (tender, too hard, dusty, etc.).	497 lbs.	560 lbs.	448 lbs.	284 lbs.	440 lbs.
22. Quantity of leaves consumed.	9,475 lbs.	18,126 lbs.	1,472 lbs.	6,366 lbs.	4,264 lbs.

STATEMENT XIV.

Comparative figures for different races of silkworms reared at the Berhampore Sericultural Research Station during April-May crop, 1920.

Name of races	No. 1, 45th generation.	No. 4, 45th generation.	J. 303, 78th generation.	Nistari.	Chotopoloo.
1. Mr. de Minvielle's reeling tests--					
(a) Silk in 80 sicca ...	5 srs. $\frac{1}{2}$ ch.	11 srs. 9 ch.	14 $\frac{1}{2}$ ch.	3 srs. 13 ch.	3 srs. 5 ch.
(b) Quantity of cocoons reeled.	96 k. 2 p.	209 k.	14 k. 8 p.	77 k.	54 k.
(c) Kahans of cocoons required per seer of silk.	19 k. 1 p. 15 $\frac{1}{2}$ g.	18 k. 1 p. 4 g	16 k.	20 k. 3 p. 3 g.	16 k. 4 p. 16 $\frac{1}{2}$ g.
(d) Chassam or floss	1 sr. 10 ch.	4 srs. 9 ch.	5 $\frac{1}{2}$ ch.	1 sr. 5 ch.	1 sr.
2. Comparative estimation :—					
(a) Percentage of dead moths.	26.26	19	7.59	15.22	6.48
(b) Percentage of Pebrine.	5	5.44	6.33	5.54	5.84
(c) Percentage of Flacherie.	38.53	43.12	23.23	29.13	46.97
(d) Percentage of disease-free moths.	56.4	51.42	70.43	65.31	47.17
(e) Percentage of yield per laying.	64.67	83.47	75.24	73.39	57.17
(f) Number of layings yielding one kahan outturn.	5.1	4.68	6.32	5.81	8.19
(g) Leaves consumed per kahan outturn.	86.86 lbs.	84.99 lbs.	93 lbs.	76.81 lbs.	75.97 lbs.
(h) Leaves required for cocoons to yield one seer reeled silk (calculated from Mr. de Minvielle's figures).	1,656.62 lbs.	1,536.45 lbs.	1,488 lbs.	1,768.55 lbs.	1,238.42 lbs.
(i) Number of cocoons weighing one seer on the 3rd day after spinning.	14 p. 7 g.	12 p. 7 g.	14 p.	14 p.	1 k.
(j) Average weight of one cocoon (with chrysalis) on the 3rd day after spinning (200 readings).	15.1 grs.	15.54 grs.	15 grs.	15.6 grs.	13.5 grs.
(k) Average weight of silky substance in one cocoon (without chrysalis) on the 3rd day after spinning (200 readings).	1.5 grs.	2 grs.	1.5 grs.	1.5 grs.	1.4 grs.
3. Variational features observed—					
(a) Larval markings	...	...	...	...	...
(b) Colour of cocoons	Yellow	Yellow	Pale Yellow	Yellow	Yellow
(c) Any other features	...	...	...	...	...
4. Remarks ...	...	...	...	...	...

STATEMENT XV.

Data regarding different races of silkworms reared at the Berhampore Sericultural Research Station during July-August crop, 1920.

Name of races.	No. 1, 47th generation.	No. 4, 47th generation.	J. 303, 79th generation.	Nistari.	Chotopoloo.
1. Date of spinning seed-cocoons.	3-7-20	24-6-20	4-5-20	3-7-20	17-5-20
2. Date of cutting out of moths.	$\frac{12}{13}$ -7-20	$\frac{2}{3}$ -7-20	13-5-20	11-7-20	27-5-20
3. Date of examination of moths.	$\frac{18}{19}$ -7-20	$\frac{8}{9}$ -7-20	19-5-20	17-7-20	2-6-20
4. Total number of moths.	300	330	176	140	375
5. Number of dead moths rejected.	90	128	50	30	100
6. Total number of moths examined.	202	192	109	85	250
7. Number of moths rejected for Pebrine.	10	9	8	6	14
8. Number of moths rejected for Flacherie.	52	43	31	29	86
9. Number of disease-free moths.	140	140	70	50	150
10. Number of improperly laid layings rejected.	8	10	10	25	25
11. Number of layings rejected for univoltine tendencies.	...	...	7	...	...
12. Temperature during seed-cutting period.	85°F.	85°F.	83°F.	85°F.	85°F.
13. Number of layings reared.	140	140	70	50	150
14. Average number of eggs per laying.	265	282	251	280	276
15. Date of hatching ...	$\frac{20}{21}$ -7-20	$\frac{10}{11}$ -7-20	21-5-20	$\frac{19}{20}$ -7-20	4-6-20
16. Date of spinning ...	$\frac{10}{13}$ -8-20	$\frac{31-7-20}{2-8-20}$	$\frac{9}{11}$ -6-20	$\frac{10}{13}$ -8-20	$\frac{24}{26}$ -6-20
17. Temperature during rearing.	86°F.	86°F.	85°F.	86°F.	85°F.
18. Total outturn of cocoons.	26 k.	33 k. 2 p.	11 k. 1 p.	9 k. 4 p.	20 k. 2 p.
19. Disposal of outturn :—					
(a) Quantity kept for seed.	10 k.	10 k.	1 k. 3 p.	3 k.	2 k.
(b) Quantity kept for sample.	2 pons	2 pons	2 pons	2 pons	2 pons.
(c) Quantity kept for cocoons for reeling.	15 k. 14 p.	23 k.	9 k. 12 p.	6 k. 2 p.	18 k.
20. Total quantity of leaves used.	2,344 lbs.	2,835 lbs.	1,019 lbs.	767 lbs.	1,643 lbs.
21. Quantity of leaves rejected (tender, too hard, dusty, etc.)	108 lbs.	113 lbs.	122 lbs.	61 lbs.	140 lbs.
22. Quantity of leaves consumed.	2,236 lbs.	2,782 lbs.	897 lbs.	706 lbs.	1,503 lbs.

STATEMENT XV.

Comparative figures for different races of silkworms reared at the Berhampore Sericultural Research Station during July-August crop, 1920.

Name of race.	No. 1, 47th generation.	No. 4, 47th generation.	J. 303, 79th generation.	Nistari.	Chotopoloo.
1. Mr. J. de Minvielle's reeling tests:—					
(a) Silk in 80 sicca ...	13 $\frac{1}{2}$ ch.	1 sr. 5 ch.	5 $\frac{1}{2}$ ch.	4 $\frac{1}{2}$ ch.	1 sr.
(b) Quantity of cocoons reeled.	15 k. 14 p.	23 k.	9 k. 12 p.	6 k. 2 p.	18 k.
(c) Kahans of cocoons required per seer of silk.	18k. 13 p. $\frac{3}{4}$ g.	17k. 6p. 7 $\frac{1}{2}$ g.	28k. 5p. 16 $\frac{1}{4}$ g.	2 k. 12p. 9g.	18 k.
(d) Chassam or floss ...	10 ch.	13 ch.	3 ch.	3 ch.	13 ch.
2. Comparative estimation:—					
(a) Percentage of dead moths.	30	38.78	28.4	21.4	26.6
(b) Percentage of Pebrine.	4.85	4.68	7.33	7	5.6
(c) Percentage of Flacherie.	25.74	22.39	28.44	34.11	34.4
(d) Percentage of disease-free moths.	51.48	72.91	64.22	58.82	60
(e) Percentage of yield per laying.	89.7	93	80.59	84.57	62.22
(f) Number of layings yielding one kahan outturn.	5.38	4.22	6.32	5.4	7.45
(g) Leaves consumed per kahan outturn.	86 lbs.	63.98 lbs.	81 lbs.	76.32 lbs.	74.68 lbs.
(h) Leaves required for cocoons to yield one seer reeled silk (calculated from Mr. de Minvielle's figures).	1,618 lbs.	1,471 61 lbs.	2,297.42 lbs.	1,628.47 lbs.	1,344.24 lbs.
(i) Number of cocoons weighing one seer on the 3rd day after spinning.	13 p. 5 g.	14 p. 5 g.	15 pons	12 p. 10 g.	13 p. 10 g.
(j) Average weight of one cocoon (with chrysalis) on the 3rd day after spinning (200 readings).	17.98 grs.	16.24 grs.	13.6 grs.	17.14 grs.	12.56 grs.
(k) Average weight of silky substance in one cocoon (without chrysalis) on the 3rd day after spinning (200 readings).	1.75 grs.	1.75 grs.	1.5 grs.	1.75 grs.	1.24 grs.
3. Variational features observed.					
(a) Larval markings	.....	.....	.....	.....	.....
(b) Colour of cocoons	Yellow	Yellow	Pale Yellow	Yellow	Yellow.
(c) Any other features	.....	.....	.....	.....	.....
4. Remarks ...	.....	.....	.....	.....	.....

APPENDIX XXIV.

ANNUAL REPORT OF THE SERICULTURAL RESEARCH EXPERT, GOVERNMENT OF BENGAL, FOR THE YEAR 1920-21.

Last year's report gave in some detail the progress of the work on the pedigree races of silkworms and the varieties of mulberry and its cultivation. Suggestions were also put forward for enormously increasing the output of Bengal silk by using the valuable and very hardy Italian-Japanese "Hybrid" and Nistri cross, from the first to the ninth generation for filature purposes only.

Pedigree races of silkworms.

The multivoltine race No. 303, a cross between the univoltine Italian-Japanese Hybrid and multivoltine Nistari which was started in January 1911 is now in the eighty-sixth generation.

Table I gives the pedigree from the seventy-seventh generation in March 1920 to the eighty-sixth generation in March 1921. These generations are the descendants of families Nos. 349, 359, 167 and 122 of the seventy-seventh generation of March 1920.

In the seventy-fifth generation the cocoons of this cross gave the best results in the trial lists, of the various cross-breeds, being carried out at Berhampore. Only 10 k. 13 g. or 12,852 cocoons were required to yield 1 seer of silk while 12 k 9 p. 5 g. or 16,100 cocoons of the other two races produced 1 seer of silk.

The cocoons of 303 race reared at Berhampore during May 1920 when the weather was unusually hot gave the best results of all the races under trial; although the cocoons were the smallest in size one seer of silk was obtained from 16 k. or 20,480 cocoons. The Ramnuggar-Madagascar race reared at Alipore, Calcutta, since March 1917, is now in the thirty-fifth generation. This race usually gives very good results during the May-June élevage. The cocoons though small are well shaped, and have scarcely any fluff, much resembling the univoltine type of cocoon. When crossed with a pure univoltine the first generation does not give the characteristic type of cocoon which invariably appears when there is any admixture of Nistari in either of the two races crossed.

Table II gives the pedigree of this race from March 1917 to April 1920.

Chinese-Madagascar Cross.

In April 1920 a cross was made between the univoltine Chinese Deep Yellow and the Ramnuggar-Madagascar. The results were rather remarkable as large rounded-end univoltine type of cocoons dominated in nearly all the generations and particularly in the first generation. Unfortunately, the Chinese race with which the cross was made was very pebrinized and although it did well during the hot weather it had to be discarded during the rainy season as the worms began to suffer from grasserie too. In connection with the fact that many of the Chinese races are so subject to pebrine it may be of interest to note that early in May 1908 I examined 229 moths of the Mysore race of silkworms about ten days or more after the moths had died and found them all free from pebrine. In 1915, however, when I examined about twenty freshly dead moths of the Mysore race I found that quite a number out of the few examined were very pebrinized.

Green worm races.

Investigations are being continued with these albino races which have been established by the selection of remarkable new characters hitherto unknown to sericulturist. These races are now in their fortieth generation.

Univoltine Italian-Japanese Hybrid.

This is the only univoltine race which does exceedingly well when reared in the plains, and the cross between this and the Nistari race gives remarkably good results up to the ninth generation. Even the univoltine layings which appear in the second generation of this cross when reared in the plains of Bengal, could be made to hatch in three months by being put in cold storage at about 50° to 55°F. a day or two after the eggs are laid.

A long series of experiments have been carried out, and the two most important discoveries made so far are—

- (1) that both univoltine and multivoltine eggs should be put in cold storage *within twenty-four hours of being laid.*
- (2) that the best temperature for hibernation is about 5° F to 55° F.

When so treated, multivoltine eggs could be *prevented from hatching for about fifty days* and univoltine eggs can be made to hatch out in three months instead of seven months.

Correlation between good cocoons and the time of the year.

It has been found that cocoons spun any time in March are of good quality, while if later in April they become small and rather flimsy. Cocoons spun in May and June are

also poor. In April, however, if there is rain for a few days, the cocoons spun a day or two after the fall in temperature are bigger and of better quality.

The moths, too, do not lay such a large number of eggs in April and May.

As the time of the year at which there is least chance of the weather becoming unfavourable for the production of a good crop would be of great value as a guide for issuing seed to the rearers, investigations are being continued to see how the time in each year corresponds to good rearings, other conditions being the same.

So far it has been found that good cocoons could always be obtained in March, July, October, November and December. Good rearings for the hot weather crop should be started about the 8th April, or even a little earlier, so that the cocoons may be spun quite early in May. Rearings which fall later in May should not be attempted for filature purposes. Cocoons spun early in April are almost as good as those of a March crop.

Mulberry.

Work was continued on the various varieties of mulberry, and innumerable drawings and botanical descriptions have been made of the various kinds collected and under investigation in the Alipore plantation. Mulberries appear to have been much neglected by both botanists and sericulturists. As most of the work I have done on mulberries, found under cultivation in India is of a very detailed nature and contains many technical descriptions I hope to have it published as a monograph on Indian mulberries.

The mulberry plantation at Alipore still continues to give heavy crops of leaf, although the trees and bushes have been stripped of leaf five times during the year under report. The plantation has had only two dressings of tank earth and cowdung once in 1915 and tank earth again in 1919. The plots are, however, deeply dug up as often as possible. Gram is sown every cold season between the rows, and sunn hemp was also grown between the rows of medium-sized bushes and trees during the cold season 1920-21.

A new plantation of about 2½ bighas of land at Tollygunge, which was very kindly lent to me for mulberry by Mr. R. Dalglish, of Messrs. Anderson Wright & Co., was dug up in September and planted out with about one thousand bushes and about ten thousand rooted cuttings. The plants are progressing well and are being cultivated as low bushes for the supply of leaf during the cold season, when there is a shortage of leaf from tree mulberry. I have much pleasure in acknowledging the work done by my sister and for the help she has very generously given me. Babu Brajendranath Pal, B.Sc., has also done good work.

M. L. CLEGHORN,

Sericultural Research Expert, Government of Bengal.

PEDIGREE OF HOT WEATHER GROUP OF 303 HYBRID RACE.

This table gives the generation, number of moth and laying, date of each *ovage* and the number of cocoons to each laying in brackets.

[illegible]

TABLE II.

Year	Month	Day	Time	Latitude	Longitude	Altitude	Distance	Direction	Remarks
1917	March	1	...	37 (14)	47 (180)				
1917	May	2	...	23 (14)	93 (80)				
1917	June	3	...	172 (108)	178 x 86 (76)				
1917	July	4	...	52 x 64 (110)					
1917	September	5	...	51 (255)					
1917	October	6	...	59 x 8 (110)					
1917	December	7	...	4 x 100 (264)					
1918	March	8	...	345, 340, 96 (3)					
1918	May	9	...	271 (17)					
1918	June	10	...	207 x 7 (168)					
1918	July	11	...	145 (328)					
1918	August	12	...	269 (150)					
1919	October	13	...						
1919	December	14	...						
1919	February	15	...						
1919	March	16	...						
1919	May	17	...						
1919	June	18	...						
1919	August	19	...						
1919	October	20	...						
1919	December	21	...						
1920	January	22	...						
1920	March	23	...						
1920	May	24	...						
1920	June	25	...						
1920	August	26	...						
1920	October	27	...						
1920	December	28	...						
1921	January	29	...						
1921	March	30	...						
1921	May	31	...						

APPENDIX XXV.

ANNUAL REPORT ON THE WORKING OF THE SERICULTURAL SCHOOL, RAJSHAHI, FOR THE YEAR 1920-21.

Administration.

The institution was made over to Government by the District Board of Rajshahi in the year 1907 ; since then it has been managed by a Committee.

Curriculum.

This school teaches the following subjects :—

- (a) Mulberry cultivation.
- (b) The Pasteur system of microscopic seed selection.
- (c) The detection and prevention of silkworm diseases.
- (d) The use of disinfectants.
- (e) The rearing of silkworms.

Towards the end of the year under report, experiments were conducted for bleaching and dyeing Indian silk, including “matka,” according to improved methods by myself. It is hoped that the results will be available to the students next year. Teaching improved methods of reeling silk even to the boys has been recommended by the Director of Agriculture, Bengal, and is under contemplation. Mr. Pillai, Weaving Expert with the Government of Bengal, has been requested to select for us an improved form of country reel for introduction in the school.

Land.

The school has in possession 22 bighas of land at Kadirganj at a distance of about one mile from the school, and of this 17 bighas are under mulberry cultivation. Extension of mulberry cultivation by an additional 3 bighas of land during the next year is under contemplation. The land however goes under water during the rains almost every year, and hence the school loses the September crop. With a view to remedy this defect, a scheme for draining the water is being worked out.

Seed supply.

During the year under report two *Nistari* crops and one *Chhotapoloo* crop were raised and the January crop failed through a disease called grasserie. The total quantity of outturn from the above three crops was 216½ *kahans* as compared with 255 *kahans* last year. Of the above quantity of seed cocoons grown in the nursery of the school during the year under report, 205 *kahans* and 8 *pans* were sold to the professional silkworm rearers and 11 *kahans* were kept in the school for microscopic examinations by the students. The total receipts by way of sale-proceeds during the year was Rs. 505-1 against Rs. 505 of the previous year. The is considered too low in comparison with the sale-proceeds obtainable in central nurseries.

Teaching staff.

The headmaster teaches sericulture to the students, including microscopic selection of seed, the use of disinfectants and the rearing of worms and has the help of a professional rearer. In addition to his own duties, the head master from time to time visits the model nurseries started by the ex-students of this school, and gives necessary instructions to the ordinary village rearers regarding the rearing of silkworms on scientific lines.

Students' work after they leave the school.

The students after receiving training for one year are awarded a reward of Rs. 250 each for erecting an up-to-date suitable rearing house, and are thus encouraged to start rearing on scientific principles. An Inspector has recently been appointed to make close supervision over the ex-students of the school.

The year's results.

During the year under report there were altogether 8 students on the roll who all appeared in the Final Examination, and of these seven passed. The seven successful students will receive their rewards next winter. During the present session (1921-22) there are altogether 12 students on the roll, of whom 7 belong to the Rajshahi district, 4 to Malda and 1 to the Murshidabad district.

Of the 12 students, 9 are Muhammadans and 3 Hindus. As the popularity of the school is increasing, proposals have been sent up to the Director of Agriculture, Bengal, for increasing the number of students from 12 to 20. The Director of Agriculture, Bengal, has recently sanctioned an increase in the monthly stipends granted to the students from Rs. 8 to Rs. 10.

Exhibition.

The school arranged exhibits in rearing silkworms in all stages and also in reeling cocoons in the Natore and Rajshahi Agricultural Exhibitions. An interesting exhibition was also arranged for the benefit of the students of the Rajshahi College. About 250 students attended. The rearing processes were explained by the headmaster who also addressed the students on the methods of improving the silk industry in Bengal.

Receipts and Expenditure during the year 1920-21.

RECEIPTS.			EXPENDITURE.		
	Rs.	A.		Rs.	A. P.
Budget grants ...	6,766	0	Pay of the staff ...	1,091	12 5
Sale-proceeds ...	505	1	Travelling allowance, etc. ...	197	7 0
Receipts from Superintendent of Agriculture, Bengal	336	9	Stipends to students ...	944	0 0
			Books and maps ...	19	12 0
			Instruments and appliances ...	200	0 0
			Petty construction and repairs ...	1,739	11 11
			Furniture ...	14	8 0
			Rents, rates and taxes ...	144	12 9
			Miscellaneous and office expenses ...	2,736	8 6
			Remittance to Treasury (sale-proceeds) ...	505	1 0
Total ...	7,607	10	Total ...	7,593	9 8

Microscopes.

There are altogether seven microscopes in stock of which three are however, useless.

Discipline.

No serious case of breach of discipline occurred during the year under report.

Inspections and visits.

The school was visited by the Director of Agriculture, Bengal, on the 2nd September 1920 and 11th February 1921 and by the Superintendent of Sericulture, Bengal, on 29th December 1920, 7th and 17th March 1921.

Meetings.

The managing committee of the school held three meetings during the year under report. The committee has been strengthened by the inclusion of the Superintendent of Sericulture, Bengal, in accordance with the suggestions of the Director of Agriculture.

Conclusion.

I am distinctly of opinion that this school has a good future before it and would be more useful if it could be made a complete school for teaching not only rearing but also reeling, bleaching, dyeing and weaving. The decay of the silk industry is due not only to the defective methods of rearing, but also on defective methods of reeling, etc., For example, the crude country method of reeling gives very uneven thread, and a slight improvement in the country reel, as suggested by Mr. R. N. Ghosh in his "Decline of Silk Industry in Bengal" and by others, would make the thread almost as even as in filatures. Then, as regards bleaching the country weavers use the impure "*sajimati*" for bleaching, but are not aware that the simple use of soap would bleach silk thread far better than '*sajimati*,' without at the same time injuring the threads.

The methods of dyeing used and confined to a few old weavers, whose numbers are fast falling off, are quite primitive, and the use of aniline dyes is almost wholly unknown. The methods of weaving again are far from being modern, and there is enough field for improvement in this direction. If these departments of (1) reeling, (2) bleaching and dyeing and (3) weaving be added to the school, I can guarantee the admission of a large number of students from the *bhadralog* class as well, to whom the award of stipends would not be necessary. I would commend these proposals for the expansion of the school to the Director of Agriculture, Bengal, for favourable consideration.

P. NEOGI,

Secretary, Sericultural School, Rajshahi.

RAJSHAHI,

The 18th April 1921.

APPENDIX XXVI.

GLOSSARY.

Vernacular.	English name.	Scientific name.	REMARKS.
Aghani ...	Winter crops.		
Aughraunbund ...	It lasts from about the middle of November to the middle of December for silk crops.		
Aman ...	Winter paddy ...	Oryza sativa.	
Amrita sagar ...	A variety of banana ...	Musa sapientum.	
Arhar ...	Pigeon pea ...	Cajanus indicus.	
Aus ...	Autumn paddy ...	Oryza sativa ...	It is called Ghaiya in Kalimpong district.
Badshabhog ...	Varieties of paddy ...	Oryza sativa.	
Bhabanibhogh ...			
Betho ...			
Chapalo ...			
Charnock ...			
Dadkhani ...			
Dapi ...			
Digha (broadcasted aman).			
Dudsar ...			
Elai ...			
Gangajali ...			
Garia ...			
Gazia ...			
Hatisal ...			
Indrasail ...			
Hasoah ...			
Jatakalma ...			
Jhengasail ...			
Kashiapanja ...			
Kataktara ...			
Kataribhog ...			
Kaminisail ...			
Kele ...			
Marichbuti ...			
Nagra ...			
Panisail ...			
Sonamail ...			
Samras ...			
Samudrabali ...			
Suryamukhi ...			
Tilakkachari ...			
Bhatmas ...	Soybean ...	Glycine Hispida ...	Dhanasi. Mansara. Ramtulsi. Ratomarsi. Timurary. Touli. These are the varieties of paddy of the district of Kalimpong. It is the Nepali name of soybean, the Lepcha name being Silliyan.
Barind ...	A tract of comparatively high land with a stiff soil of reddish clayey loam which runs through the districts of Rajshahi, Malda, Dinajpur and Bogra.		
Bashnis ...	Bengal silkworm rearers.		
Bigha ...	A bigha is equal to one-third of an acre.		
Bhodes ...	Clayey deposit in old tanks.		
Beel land or bhil	.....	.....	Lowlying lands which serves as reservoirs of flood water during the rain.
Bhadoi ...	Autumn crops.		
Bhideshi ...	Foreign, exotic.		
Bogi seed ...	Seed of a variety of jute called Bogi.	Corchorus sp.	

Vernacular.	English name.	Scientific name.	REMARKS.
Bunds ...	Seasons for silk crops.		
Bundh ...	An embankment by the side of a river.		
Buri ...	A variety of cotton ...	Gossypium sp.	
Chotopoloo ...	A variety of silkworm.		
Chhusum ...	Waste silk.		
Dharwar ...	A variety of cotton ...	Gossypium sp. ...	
Dhaincha ...	.....	Seabania aculeata.	
Deshi ...	Indigenous.		
Deshi tunt or tut ...	Mulberry ...	Morus indica ...	It is called Chota kimbu in Kalimpong district.
Dones ...	An appliance for irrigation.		
Gangajali ...	A variety of wheat ...	Triticum sativum.	
Gur ...	Molasses.		
Gahat or Kulthi ...	Horsegram ...	Delichos Biflorus	Gahat being the Nepali name.
Jhills ...	Small lakes.		
Joars ...	Groups of villages ...	.....	Technical term used in Sericulture.
Joar ...	Sorghum ...	Sorghum vulgare.	
Dukhary ...	Varieties of millet ...	Ditto ...	It is called kodo in Kalimpong.
Fulgar ...			
Sundhia ...			
Kahan ...	1,280 units make one kahan.		
Kutchra ...	Mud built.		
Kalai or mati kalai ...	A variety of pulse ...	Phaseolus radiatus.	
Kharif season ...	Winter season.		
Khesari ...	A variety of pulse ...	Lathyrus sativa.	
Khar ...	Thatching grass.		
Maund ...	It is equal to 82.31 lbs		
Mashyem ...	A sort of gram ...	Phaseolus calcaratus.	It is a Nepali name.
Mela ...	Fair.		
Mung ...	A variety of pulse ...	Phaseolus Mungo.	
Nistari ...	A variety of silk-worm.		
Pucca ...	Brick built.		
Rabi season ...	Spring season.		
Rohit ...	A variety of big fish of the carp species.		
Til ...	Gingelly ...	Seasamum indicum.	
Ufra ...	An eel worm disease of rice.	Tylenchus sp.	
(i) Dacca Bas ...	Varieties of jute ...	(i) Corchorus capsularis. * Corchorus olitorius.	
(i) Fandak ...			
* Hooghly Deshi ...			
(i) Hewti ...			
(i) Kakiabomby ...			
(i) Simulkandi ...			
* Tosha ...			
Bhengi ...	Varieties of tobacco ...	Nicotina tobaccum.	
Bispat ...			
Hamaku ...			
Matihari ...			
Naokhol ...			
Gandari ...	Varieties of sugarcane	Saccharum officinarum.	
Shamsara ...			
Khagri ...			
Vendamukhi ...			

GOVERNMENT OF BENGAL.

DEPARTMENT OF AGRICULTURE AND INDUSTRIES.

Agriculture.

CALCUTTA, THE 28TH NOVEMBER 1921.

RESOLUTION—No. 4551Agri.

The Hon'ble

Nawab Saiyid Nawab Ali Chaudhuri,
Khan Bahadur, C.I.E.,

Minister in charge.

READ—

The Report of the Department of Agriculture, Bengal, for the year 1920-21.

The principal change in the administration of the Department of Agriculture during the year under review was the transfer of control from the Revenue Department of the old Government to the Ministry of Agriculture and Public Works under the Reformed Government.

For the first three months of the year, Mr. R. S. Finlow officiated as Director of Agriculture in addition to his own duties as Fibre Expert. He was relieved on the 5th July 1920 by Mr. G. Evans, C.I.E., who was selected by Government to succeed Mr. Milligan as the permanent Director. A new post of second Economic Botanist was sanctioned during the year, and Mr. D. Dutta, Superintendent of Agriculture, was appointed to officiate in it. In the Sericultural section, three new appointments, viz., the Deputy Director of Sericulture, the Second Superintendent of Sericulture and the Sericultural Research Expert, were created. As in previous years, there were three Deputy Directors for the five civil divisions. The necessity of having a Deputy Director for each division has been recognised for some time past, and the Government have applied for the sanction of the Secretary of State to the creation of two new posts of Deputy Director. In view of the expanded programme of work now under contemplation, an increase in the subordinate staff employed on demonstration work has also become necessary.

2. There were 42 students from Bengal at the Agricultural College at Sabour, of whom 18 appeared in the final examination and 11 passed. Five students received scholarships from Government and seven from district boards. The first batch of students at the Agricultural Vernacular School at Dacca will complete their course in December next. A school of the same type was opened at Chinsura in February 1921, but only 12 students were on the roll at the close of the year. The paucity of pupils is attributed to the non-co-operation movement. The object of Government in opening these schools was to provide a practical education in modern agricultural methods for the sons of cultivators who would apply what they learned in the cultivation of their own holdings. Experience has now shown that these schools are not altogether suitable. The principal drawback is that they are much too costly. If agricultural education is to spread among the masses, it is essential that the schools should be within easy reach of the cultivators. Numerous schools, each serving a comparatively limited area, must therefore be established, and this can only be accomplished if a cheap type of school is devised. It has therefore been proposed that the schools at Dacca and Chinsura should be converted into secondary agricultural schools, where *gurus* and demonstrators, and also cultivators desiring a higher agricultural

education, would be trained, while for elementary agricultural education a cheaper type of school should be evolved. A scheme for such schools is now engaging the attention of the Hon'ble Minister.

An area of 300 acres has been acquired adjacent to the Dacca Agricultural Farm for the Agricultural Institute. The scheme has received the administrative sanction of Government, and building operations will commence as soon as funds are available.

3. The research work of the department is divided into the Fibres, Botanical and Chemical sections. In the Fibres section, Mr. Finlow continues to devote most of his time to jute, though flax, hemp and other fibres have also received attention. The success of the *Kakya Bombai* variety of jute is well known. But two new races, R 85 and D 154, are expected to prove superior to *Kakya Bombai* as they give a somewhat better yield and are immune from the attacks of *chlorosis*. This disease is now being investigated by the Fibre Expert, in collaboration with the Economic Botanist. The Botanical section is testing three new varieties of *aman* paddy and is investigating the problem of early paddies for the high lands of Bankura and Birbhum. Cotton is also receiving attention, but experience has shown that long-staple cotton as a rains crop is not likely to be a commercial success in Bengal. Experiments with cold weather cotton will be initiated this year. In the Chemical section, work on the soil survey of the province has had to be curtailed owing to shortage of staff, but the analysis of soils from the new Government farms has been carried out, and very important work in connection with tobacco has been started. This includes an investigation into the manuring of the crop and a study of the various methods of curing and fermenting the leaf.

4. It is the aim of Government to provide every district with an agricultural farm where new varieties of crops and manures will be tested and adapted to local conditions and which will form a centre for all the agricultural work of the district. The Hon'ble Minister agrees with the Director of Agriculture that there should also be a central experimental station in each division at which experimental work of a high order can be conducted; and he recognises that the department is seriously handicapped at present in its experimental work by having only two such stations at Dacca and Chinsura. The provision of additional experimental stations must, however, await an improvement in the financial position. Meanwhile, as a temporary measure, arrangements are being made to conduct some experimental work on the Rajshahi Farm.

5. It is a satisfactory feature that the Director is able to report a considerable increase of public interest in agricultural matters and in the work of the department. An indication of this is the remarkable demand for departmental seed. In the Dacca Division, for instance, applications were received for 5,000 maunds of *Kakya Bombai* jute seed against an available supply of 800 maunds. There was also a keen demand for seed of the *Kataktara* and *Indrasail* varieties of paddy. It is obvious that the seed which the district farms will be able to supply will be quite insufficient to meet the needs of the cultivators. The Director has, therefore, drawn up a scheme for utilising private agencies for the propagation and distribution of departmental seed. The central experimental stations will supply seed to the district farms. These in turn will distribute it to private farms established through the agency of zamindars, khas mahals, Court of Wards' estates and co-operative agricultural associations. The seed will be propagated for a further period in these farms before distribution to the cultivators. The Hon'ble Minister is glad to learn that satisfactory progress in the organisation of these private farms has already been made, and looks forward with interest to the detailed report on their working which is promised for next year.

6. The demonstration work of the department is by no means confined to jute and paddy. Many varieties of sugarcane from all parts of the world have been tested, and the *Yellow Tanna* variety, which has proved itself pre-eminently adapted to the conditions of Bengal, has achieved a

wide popularity. Every effort is being made to increase the supply of seed of this variety to meet the large demand which exists. Tobacco is also an important item in the demonstration programme, and the cultivation of the Sumatra variety has been rapidly extended in Rangpur. The Minister attaches great importance to the formation of a co-operative sale society among the cultivators of tobacco as he is convinced that this is the best method of securing for the cultivators a good price for their crop. He trusts that the efforts which are being made to establish such a society will meet with a full measure of success. Other crops which are receiving attention include groundnuts, wheat and potatoes, and the use of manures is also being popularized by the demonstrations of the department.

7. The cattle-breeding experiments on the Rangpur cattle farm continued to make progress. The herd is divided into two sections. In the one selected local cows breed from a Hissar bull, and in the other from the best local bulls available. The milk yield of each cow is carefully recorded, and those which give a poor yield are eliminated from the herd. Several generations will have to be bred before definite results can be expected, but the half-bred Hissar bulls are at present showing distinct signs of improvement over the local animals.

8. During the year considerable attention was paid to the formation of village agricultural associations, and their rapid expansion affords further evidence of the increase of popular interest in the work of the department. In order to secure the permanence of these associations, and to give each member a personal interest in their success, the Minister has decided that they should in future be organised as far as possible on a co-operative basis. Associations or small groups of associations will be registered as co-operative agricultural societies under the Co-operative Societies Act, and share capital will be raised. These societies will not only engage in such activities as the supply of seed and manure to members, but will also be in a position to undertake the more complicated forms of agricultural improvement such as irrigation and drainage projects and the joint purchase and sale of agricultural machinery.

9. The Sericultural branch of the department continued to do important work during the year under review. The demand for seed cocoons greatly exceeded the supply. Owing to a shortage of the mulberry crop which was affected by drought and to an accidental outbreak of muscardine at one of the nurseries, the total receipts from the nurseries amounted only to Rs. 77,286 as against Rs. 84,185 in the previous year. In spite of this, it is estimated that the department supplied 29 per cent. of the total seed requirements of the province. The increasing demand for sericultural education is an indication that the cultivators appreciate the value of the work that is being done by the department. The Minister in charge takes this opportunity of acknowledging the good work of Rai Sahib A. C. Ghosh, Superintendent and officiating Deputy Director of Sericulture, who has retired since the close of the year after being in charge of the sericultural work of the department from 1907.

10. The report is a record of continued progress and good work. The Hon'ble Minister desires to congratulate Mr. Evans on his successful administration of the department during his first year of office.

His acknowledgments are also due to Mr. Finlow for his excellent work both in his capacity of Fibre Expert and as officiating Director, to the other officers of the department whose services Mr. Evans has brought to notice, and to the large number of gentlemen, both official and non-official, who have rendered assistance to the department.

By order of the Government of Bengal
(Ministry of Agriculture and Public Works),

J. A. L. SWAN,
Secretary to the Government of Bengal.

No. 4552.

Copy forwarded to the Director of Agriculture, Bengal, for information.

By order of the Government of Bengal
(Ministry of Agriculture and Public Works),

M. CHAIN-UD-DIN,

Assistant Secretary to the Government of Bengal.

CALCUTTA :

DEPT. OF AGRI. AND INDUS. — *Agri.*

The 28th November 1921.

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